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MANUAL

OF

CONCHOLOGY;

STRUCTURAL AND SYSTEMATIC.

WITH ILLUSTRATIONS OF THE SPECIES.

FOUNDED BY

GEORGE W. TRYON, JR.

CONTINUED BY

HENRY A. PILSBRY, Sc.D.,

CONSERVATOR OF THE CONCHOLOGICAL SECTION OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA.

Part .....

Index to vols. 9-14

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CLASSIFICATION OF BULIMULIDÆ AND INDEX TO VOLUMES X, XI, XII, XIII AND XIV.

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This part contains a classification of the Bulimoid snails described in volumes x, xi, xii, xiii and xiv, with an Index to genera and species. It may either be bound with vol. xiv, or as a separate index volume.

All references herein to figures of the anatomy of Bulimi, refer to the plates of vol. xiv.

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INTRODUCTION.

Owing in part to the absence of anatomical data, in part to the want of sufficient knowledge to interpret the facts in our possession, a number of groups belonging to the *Helicidæ* were formerly referred to the *Bulimulidæ* or "*Bulimidæ*," by reason of the lengthened and Bulimoid contour of their shells. Investigations made during the progress of the monographs on Bulimi have shown the true relationships of several of these genera.

Family ZONITIDÆ.

Genus CALYCIA H. AD. xiv, p. 20.

The following genera are to be added to the *Helicidæ* enumerated in vol. ix of this series.

Family HELICIDÆ (*sensu Pils.*)

Subfamily CAMÆNINÆ (*Epiphallogona*).

Genus AMPHIDROMUS Albers, 1850.

Man. Conch. xiii, p. 127; xiv, pp. 167, 282. A Bulimoid group of arboreal snails, extending from Indo-China to Timor.

Section *Syndromus* Pils., vol. xiii, p. 184. Same geographic range.

Subgenus BEDDOMEA Nevill, xiv, p. 1. Southern India and Ceylon.

Subgenus PSEUDOPARTULA Pfr., xiv, p. 9. Java, Sumatra and Borneo.

Genus DRAPARNAUDIA Montr. 1859.

Man. Conch. xiv, p. 12. New Caledonia and New Hebrides.

Subfamily HELICINÆ (*Belogona*).

(*Belogona Euadenia.*)

Genus EULOTA Hartm. (Vol. ix, p. 200).

Subgenus DOLICHEULOTA Pils., vol. xiv, p. 18. Formosa.

(*Belogona Siphonadenia.*)

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Genus CYLINDRUS Fitz.

Family ACAVIDÆ Pilsbry.

Macroogona Pils., Man. Conch. ix. Additional species are described in xiii, pp. 122–126.

Subfamily STROPHOCHILINÆ.

This group differs from the *Bulimulidæ* by the long kidney, absence of a tubular ureter, copious venation of the cardiac side of the lung; the solid, smooth jaw, etc., etc. Suitable description and illustration of the soft anatomy of the group would occupy undue space in the Manual, and will be given elsewhere; but as *Gonyostomus* has been associated hitherto with *Bulimulinæ* it has been thought best to include some account of its anatomy here, in order to fix the position of the group.

Two genera of this subfamily are known, *Strophocheilus* and *Gonyostomus*.

Genus STROPHOCHEILUS Spix.

Man. Conch. x, p. 1. The genus as constituted in vol. x requires some restriction, the group *Thaumastus* proving by its soft anatomy to belong to the family *Bulimulidæ*.

Subgenus STROPHOCHEILUS *s. str.*

S. pudicus Müll., xiv, p. 116.
almeïda Spix.
S. planidens Mich., x, 7.
S. rhodocheilus Rve., x, 8.
S. pilsbryi v. Iher., xiv, 118.
S. milleri Sowb., x, 8.
v. kronei Iher., xiv, 118.
v. iguapensis Pils., xiv, 119.
S. calus Pils., xiv, 119.
S. unidentatus Sowb., x, 9.
S. erythrosoma Pils., x, 10; xiv. 117.
pudicus Pfr.
S. (?) contortuplicatus Rve., x, 71.

Subgenus BORUS Alb., 1850.

Man. Conch. x. pp. 10, 194; xiv, p. 120. Distribution, tropical and temperate South America.

S. popelairianus Nyst, x, 13.
v. thammianus Mart., x, 14.
v. dohrnianus Mart., x, 14.
v. connectens Mart., x, 14.
S. maximus Sowb., x, 15.
v. kremnoicus Orb., x, 16.
S. huascari Tschudi, x, 16.

S. santacruzii Orb., x, 16.
santacruzensis Pfr.
sanctæ crucis Beck.
S. lacunosus Orb., x, 17.
S. mathiusii Orb., x, 17.
matthewsii Beck.
leucostoma Sowb.
mahogani Sowb.
S. durfeldti Dohrn, x, 18.
S. hupeanus Morel., x, 19.
castelnaui Hupé.
S. cacopatensis Pfr., x, 20.
S. granulosus Rang, x, 20.
S. yporanganus Iher. & Pils., xiv, 120.
S. valenciennesi Pfr., x, 21.
fulguratus Val.
S. cantagallanus Rang, x, 22.
accelerans Mart.
proximus Sowb.
terrestris Spix.
corrugatus Wagn.
v. intercedens Mart., x, 22.
S. gummatus Hid., x, 23.
S. ovatus Müll., x, 24.
hæmastomus Spix.
ovum Ads.
Helix ovalis Mawe.
Lymnæa imperialis Lea.
v. chionostomus Mörch, x, 25.
S. grandis Mart., x, 26; xiv, 122.
S. iheringi Cless., x, 196; xiv, 122.
proclivis Mart., x, 195.
S. auritus Sowb., x, 26; xiv, 121.
S. oosomus Pils., x, 27.
S. fragilior Iher., xiv, 121.
S. bronni Pfr., x, 28.
browni H. & A. Ads.
v. pergranulatus Pils., xiv, 120.
S. paranaguensis Pils. & Iher., xiv, 124.
S. oblongus Müll., x, 29; xiv, 122.
Turbo hæmastomus Gmel.
Helix ovipara Portl. Catal.
B. roseus Montf.
Helix semilineata Mke.
Melania carnatis Perry.
v. crassus Alb., x, 30.
v. albolabiatus Smith, x, 197.
tobagoensis Pils., x, 30.
albus W. G. B., xiv, 123.
v. alba Smith, x, 197.
S. sanctipauli Iher. & Pils., xiv, 123.
sanctæpauli olim.
S. capillaceus Pfr., x, 31.
v. seneri Jouss., x, 31.
v. intertextus Pils., x, 32; xiv, 123.
S. lorenzianus Doer., xiv, 125.
S. lichtensteini Alb., x, 32.
S. rosaceus King, x, 33.
S. crenulatus Pfr., x, 33.
Bulinus chilensis Sowb.
B. credulatus Nev., xiv, 126.
B. squamulatus C. & J. (?)
S. crenellus Phil., x, 34.
S. pachychilus Pfr., x, 35.
S. bridgesi Pfr., x, 35.
S. lutescens King, x, 36.
nucleus Sowb.
v. australis Mart., x, 36.
dorbignyi Doer., xiv, 126.
v. cordilleræ Doer., xiv, 125.
S. globosus Mart., x, 37; xiv, 124.

Subgenus DRYPTUS Alb., 1860.

Man. Conch. x, p. 37. Distribution, Venezuela and Colombia. The systematic position of this group cannot be regarded as fully settled.

S. moritzianus Pfr., x, 38.
v. wilsoni Pils., x, 39.
S. indentatus DaC., xiv, 281.
S. guerini Pfr., x, 39.
S. pardalis Fér., x, 39.
leptochilus Pfr.
astropoides Jonas.
S. marmoratus Dkr., x, 40.
S. venezuelensis Nyst, x, 41.
S. stubeli Mart., x, 42.
S. funcki Nyst, x, 42.
superbus Jonas.
adoptus Rve.

Genus GONYOSTOMUS Beck, 1837.

Man. Conch. x, pp. 96, 121.

Shell rimate-umbilicate, fusiform or ovate-conic, rather thin, composed of 5 to $5\frac{1}{2}$ gently convex whorls. Surface finely granose in spiral series. Aperture elliptic or ovate, angular above, rounded or angular below; the peristome evenly, narrowly expanded or reflexed. Outer lip regularly arcuate, without callous projections within. Columellar lip free, inserted high, the columella with a weak, deeply placed fold.

The foot (pl. 53, fig. 35, *G. multicolor*) is coarsely reticulated, the tubercles being large and polygonal at the sides much smaller on the dorsal surface of body and tail, three black stripes run parallel on the back, parted by two slightly wider reddish bands which terminate at the tentacles. The sole shows no trace of longitudinal division.

Kidney much longer than the pericardium, projecting backward. Ureter and secondary ureter open throughout, but represented by a distinctly differentiated band. Reticulation of the lung almost evenly spreading over both intestinal and cardiac sides, the vena cava and pericardial vein each supplied with several large branches (pl. 49, fig. 8, *G. multicolor*, x 2).

Free retractor system as in *Bulimulidæ*, the pharyngeal retractor being shortly connected with the left tentacular band, and the columellar muscle or tail retractor with the right band (pl. 54, fig. 37, *G. turnix*, x 2).

Genitalia (Pl. 51, fig. 16, *G. turnix*, x 2; pl. 52, fig. 26, *G. multicolor*, x 2; fig. 27, vagina of same), much as in *Strophocheilus*. The penis is long, cylindrical and fleshy, bearing the

vas deferens and retractor at its summit. The vagina is long, and continued in a sort of pouch above the entrance of the spermatheca duct (pl. 52, fig. 27). The latter is slender and nearly as long as the oviduct. The ovisperm duct is imbedded in the concave side of the albumen gland nearly to the distal end of the latter.

The intestinal tract is of the usual four-folded type. The jaw is strong, arcuate, solid and smooth, with a slight median projection (pl. 57, fig. 59, *G. turnix*), or highly arched with a strong projection (pl. 57, fig. 67, *G. multicolor*). The radula has the formula 39.1.39 in *G. turnix* (pl. 57, fig. 68). The central and lateral teeth bearing single, broadly rounded cusps. The change to marginal teeth begins about at the 15th tooth, a division of the cusp into mesocone and ectocone gradually ensuing. A few extreme marginals are irregular in shape, as usual. In *G. multicolor* (pl. 57, figs. 65, 66) the formula is about the same, but the cusps are longer and less broadly rounded.

Type *G. goniostoma*. Distribution, southern Brazil.

This genus was formerly considered a subgenus of *Bulimulidæ* subordinate to *Auris*. The examination of alcoholic specimens of two species, received from Dr. H. von Ihering, shows that it has no affinity to *Auris* or other Bulimuline genera, but is a member of the *Strophochilinæ*, closely related to *Strophocheilus*, from which it differs chiefly in the form of the shell. The form of the kidney, absence of any tubular ureter, the pattern of the lung, the solid jaw, unicuspid, median teeth of the radula, in fact the whole anatomy, is Strophocheiline, and widely different from the Bulimuloid genera.

My former treatment of this group is an instructive commentary on the inconclusive nature of purely shell characters. Before I had dissected *Gonyostomus* I thought it a member of the *Bulimulidæ*, while *Thaumastus* I took to be a subgenus of *Strophocheilus;* whereas the anatomy conclusively shows that *Gonyostomus* belongs to the *Strophochilinæ*, and *Thaumastus* is a typical member of the *Bulimulinæ*. And in dealing with both genera I had before me specimens of the shells of nearly every species for study.

The genitalia of *Gonyostomus* present some interesting features. The vas deferens in *G. turnix* adheres to the vagina, upon which it pursues a sinuous course (pl. 51, f. 16). The vagina is plicate within (pl. 52, fig. 27, *G. multicolor*, *v*, vagina ; *sp*, lower end of the spermatheca duct ; *o*, lower end of the oviduct ; *s*, accessory sac).

It continues upward beyond the entrance of the spermatheca, terminating in a short blind sac. This sac is homologous with the accessory sac at the base of the spermatheca in *Strophocheilus*, and perhaps with the appendiculum of *Panda* and *Pedinogyra*. The lower portion of the ovi-sperm duct is imbedded in the albumen gland as in *Ampelita*. There is no sheath about the base of the penis in *G. turnix*. The lumen of the penis is large, longitudinally plicate, the folds crenulate. No papilla.

In *G. multicolor* the lung is black-pigmented except posteriorly. The spermatheca lies near the inner end of the pericardium.

G. goniostoma Fér., x, 122.
G. erubescens Swains.
G. hybrida Gld., x, 123.
B. egregius Pfr.
G. turnix Gld., xvi, 133.
G. multicolor Rang, x, 123.
G. miersii Sowb., x, 124.

Family BULIMULIDÆ.

Shell usually oblong or ovate, rarely columnar, helicoid or partially degenerate and Succinea-like. *Kidney triangular, as short as the pericardium*, with a reflexed ureter, and closed or rarely open secondary or gut ureter. Lung having *a long unbranched pulmonary vein*, the first branch of the pericardial vein sometimes well-developed, a branch of the vena cava lying between them; *the reticulation chiefly confined to the region near the pneumostome* between the last-named branch and the rectum, *and the tract between the pulmonary vein and the last fold of the gut. Jaw made up of vertical or converging plates* concrescent except at their outer and usually imbricating margins (rarely completely united, and smooth). Radula of the ordinary Helicid type or variously specialized. Intestine of the usual four-folded type. In the free retractor muscle system the right ocular band arises from the face of the columellar muscle and the left ocular band is united for a greater or less distance with the pharyngeal retractor muscle.

While related to the *Helicidæ*, snails of this family are well characterized by the triangular kidney, not exceeding the pericardium in length. The jaw, lung and shell are also to a less extent characteristic. The *Acavidæ* and especially the *Strophochilinæ* are likewise allied to *Bulimulidæ*, but in these groups the kidney is oblong, prolonged backward, the ureter is imperfect or wanting, the jaw solid, the pattern of lung venation diverse, and the nepionic shell larger.

Those *Helicidæ* having a Bulimoid shell, such as *Amphidromus*,

Draparnaudia, *Helicostyla*, etc., differ from all *Bulimulidæ* in important features of the pallial organs, genitalia, etc. The same is true of the *Partulidæ* and *Buliminidæ*, groups closely imitating *Bulimulidæ* in the form of the shell.

All the subfamilies and a large majority of the genera are South American. Two genera, *Bulimulus* and *Drymæus*, belonging to the most primitive subfamily of the group, *Bulimulinæ*, extend into the West Indies and North America; and two others, *Bothriembryon* and *Placostylus*, occur in Australasia, giving testimony to the former existence of an Antartic land connecting the austral continents of the two hemispheres. The other subfamilies are more specialized, and confined to middle and South America. All *Odontostominæ* are South American. The *Orthalicinæ* inhabit tropical South America, with two genera, *Oxystyla* and *Liguus*, in the Antilles, Mexico and Southern Florida. The subfamily *Amphibuliminæ* has the same distribution, two genera being Antillean and Mexican, two South American.

The past history of the *Bulimulidæ* is still most obscure. The numerous modifications of the group, and its omnipresence in South America lead us to believe it an old group there, and probably it arose in that region. Its advent in continental North America has obviously been a recent incursion from the South, and the Australasian groups also are emigrants from South America. But while its chief characteristics must have been well established in Cretaceous or Jurassic times, there is yet no trace of *Bulimulidæ* in Africa. This is somewhat remarkable because *a former land connection with Africa through the mid-Atlantic*, as claimed by Koken and others, is emphatically proclaimed by the *Streptaxidæ*, *Achatinidæ* (*Neobeliscus*, etc.), *Ampullariidæ*, freshwater fishes, etc., of South America. This is altogether independent of the problematic connection of South Africa and Antarctica, claimed by certain naturalists, and supported to some extent by the dominence of *Endodontidæ* of Austral types in the Cape region and St. Helena.

Classification of Bulimulidæ.

The family may be divided into four subfamilies, as follows:

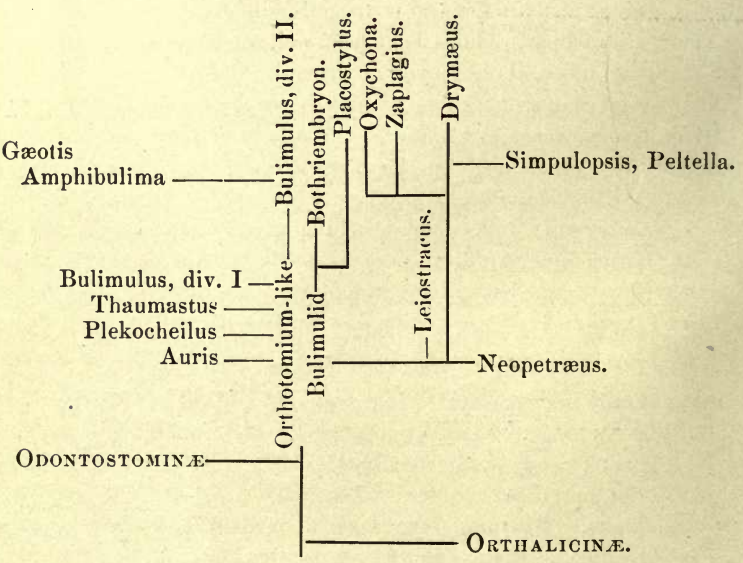
I. Bulimulinæ. Shell usually perforate or umbilicate, usually ovate, rarely cylindrical or Helicoid; generally rather small, the aperture toothless. Jaw with vertical or converging plaits. Teeth of the normal Helicid type or variously modified. Genitalia without accessory organs.

II. ODONTOSTOMINÆ. Shell varying from fusiform to Helicoid. Aperture usually obstructed by internal lamellæ, folds or teeth. Jaw plaited or solid. Dentition Helicid. Genitalia simple.

III. ORTHALICINÆ. Shell ovate-conic or oblong, imperforate, with solid axis, usually rather large and strikingly colored, the aperture toothless, sometimes with a columellar fold. Jaw strong, with rather few, wide plaits. Teeth in V shaped rows, bearing single broad, gouge-shaped cusps, the median teeth sometimes lance-shaped. Penis provided with an accessory gland or appendix.

IV. AMPHIBULIMINÆ. Shell more or less degenerate, globose, oblong, *Succinea*-shaped or *Haliotis*-shaped, always thin and mainly cuticular. Jaw very delicate and highly arched, composed of many close, converging plaits. Radula variously specialized, the cusps large. Genitalia simple.

With the exception of the last subfamily, these groups seem to be natural. The main lines of generic affinity, and approximate phylogeny, may then be represented by the accompanying diagram. The relationships of the genera of *Orthalicinæ* to one another have been considered elsewhere (vol. xii, p. 100), those of the genera of *Odontostominæ* in this volume.



Artificial key to genera of Bulimulidæ, by shell characters.

The *Amphibulimæ* (see above) are not included in this key.

Shell Helicoid or trochiform, capable of standing more or less upright upon the base.

a. Aperture conspicuously contracted by teeth or folds.

b. Aperture turning upward; shell biconvex, mottled. *Anostoma*, xiv, 109.

b^1. Aperture oblique, shell transversely oval or trochiform. *Tomigerus*, xiv, 105.

a^1. Aperture toothless.

b. Apical whorls most minutely, evenly grated (as in pl. 15, f. 31); not umbilicate.

c. Last whorl distorted; basal lip advanced. *Zaplagius*, xi, 185.

c^1. Last whorl normal; shell trochiform. *Oxychona*, xi, 181.

b^1. Apical whorls not so sculptured; shell earthy, dull and opaque, openly umbilicate.

c. Aperture angular, oblique, the lip simple, discontinuous. *Platybostryx*, x, 129.

c^1. Aperture subhorizontal, the lip flaring, continuous. *Xenothauma*, xiv, 134.

Shell ovate, oblong or pillar-shaped, "Bulimoid."

a. Apical whorls smooth.

b. Lip reflexed, often conspicuously thickened; shell usually solid and rather large.

c. Aperture angular below, or with sinuous lip; or the lip bears a callous flange. *Auris*, x, 95.

c^1. Aperture broadly rounded below, *Plekocheilus*, x, 62. *Porphyrobaphe*, xii, 149.

b^1. Lip reflexed; aperture oblong with *parallel* margins; size small. *Anctus*, xiv, 36.

b^2. Lip acute, not at all expanded; shell rather large, wholly imperforate, the columellar lip completely adnate; often conspicuously colored. *Oxystyla*, xii, 101. *Liguus*, xii, 160.

b^3. Lip acute and simple or expanded; shells of moderate or small size, usually perforate or rimate. *Bulimulus*, division I, x, 127. *Neopetræus*, in part, xi, 163. *Leiostracus*, xii, 90.

a^1. Apical whorls most minutely, evenly cancellate, as in pl. 15, fig. 31, neither spiral nor vertical sculpture predominating; or in other words, with minute pits in spiral and straight vertical series.

b. Shell strong, the peristome thick, with strong callous flanges within lip and columella; spire short. *Otostomus*, x, 107.

b^1. Shell elongate, the aperture having teeth, or angular below. *Odontostomus*, xiv, 38.

b^2. Aperture without teeth or folds; shell rather thin.

c. Base obliquely truncate. *Zaplagius*, xi, 185.

c^1. Base tapering, rarely angular; lip varying from unexpanded to reflexed. *Drymæus*, xi, 191.

a^2. Apical whorls with straight vertical riblets.

b. Aperture provided with teeth or folds. *Odontostomus*, in part, xiv, p. 38.

b^1. Aperture ovate, without teeth.

c. Intervals between the apical riblets conspicuously striate spirally. *Neopetraeus*, xi, 163.

c^1. Intervals smooth or weakly striate spirally. *Bulimulus*, division III, xi, 83; and *Bothriembryon*, in part, xiii, p. 1.

a^3. Apical whorls sculptured with waved, irregular or dislocated wrinkles, sometimes forming a net or mesh pattern, or pitted in the pattern of a thimble.

b. Aperture with several pliciform teeth or folds. *Odontostomus*, in part, xiv, p. 93.

b^1. Aperture with obtuse teeth, or a callus on the parietal wall defining a posterior groove; whorls $4\frac{1}{2}$ to $5\frac{1}{2}$. *Hyperaulax*, xiv, p. 102.

b^2. Aperture ovate, without teeth or posterior groove.

c: American genera.

d. Wholly imperforate, large, elaborately variegated, apex conspicuously thimble-pitted. *Orthalicus*, xii, 186.

d^1. Usually rimate or umbilicate; rather large, brown or marked with brown.

e. Shell dappled or zigzag-streaked. *Plekocheilus*, x, 62.

e^1. Shell streaked, banded or unicolored. *Thaumastus*, x, 43.

d^2. Perforate, rimate or umbilicate, smaller; plain, streaked or banded.

Bulimulus, division II, xi, p. 1.

c^1. Australasian genera.

d. Auriculoid, the lip thickened, expanded or reflexed. *Placostylus*, xiii, 19.

d^1. Bulimulus-like, the lip simple.

Bothriembryon, xiii, 1.

a^4. Apical whorls spirally striate; aperture toothed.

Macrodontes, xiv, 29.

Subfamily I. BULIMULINÆ.

The numerous genera of this subfamily may be classified provisionally thus:—

1. *Radula with teeth of the normal or unspecialized Helicid type.*

(American genera.)

a. Shell rather large, ovate or oblong.

b. Lip conspicuously calloused or with a callous flange, or having the aperture distorted. *Auris*.

b^1 Aperture ovate, the lip without calluses.

c. Ovate, the shell dappled, maculate or zigzag striped, *Plekocheilus*.

c^1. Oblong, streaked or with a few wide bands; nepionic shell rather large and sculptured. *Thaumastus*.

a^1. Shell much depressed, with crater-like umbilicus, subhorizontal aperture and continuous flaring peristome. *Xenothauma*.

a^2. Shell *ovate*, pillar-shaped or Helicoid, plain, banded or streaked, the aperture with simple or expanded peristome. *Bulimulus*.

(Australasian genera.)

a. Shell rather thin, Bulimulus-like, the peristome simple. Duct of the spermatheca long. *Bothriembryon*.

a. Shell auriculoid, the peristome reflexed or expanded, generally much thickened and bright colored. Duct of the spermatheca short. *Placostylus*.

2. *Radula with variously specialized teeth, unlike the ordinary Helicid type. Jaw very thin and flexible.* (All American.)

a. Shell ovate or oblong, usually with a peculiar color-pattern of oblique streaks; the apical whorls sculptured with vertical riblets and finer, lower, spiral striæ, sometimes smooth. Rows of teeth

only moderately curved, the teeth of the median portion of the radula having single, exceedingly long, oblique, blunt or emarginate cusps. *Neopetræus.*

a^1. Apical whorls of the shell sculptured with an exceedingly fine, even grating, formed by minute pits regularly arranged in spiral and vertical series (as in pl. 15, fig. 31).

b. Periphery of shell angular, or base obliquely truncate or flattened; teeth of the median portion of radula having enormously expanded, rounded cusps (entocone and mesocone), and minute, spur-like, basal ectocones; the transverse rows V-shaped, running obliquely *backward* from the middle.

c. Shell trochiform, smooth, regular. Plaits of the jaw vertical and parallel. No entocone appearing on the teeth. *Oxychona.*

c^1. Shell with conic spire, the last whorl running upward, or obliquely truncate below. Jaw high-arched, with narrow converging plaits. Entocone conspicuous on the outer lateral and marginal teeth. *Zaplagius.*

b^1. Shell ovate or oblong. Teeth of the radula excessively numerous, with indistinct basal-plates, arranged in variously curved rows, but running obliquely *forward* on each side of the rhachis; all the lateral teeth of a peculiar tricuspid form. *Drymæus.*

a^2. Apex of shell nearly smooth, but usually showing some low irregular longitudinal wrinkles, and faint, fine, spiral striæ. Radula with comparatively few teeth in a transverse row, the rows running a little backward from the rhachis. Lateral teeth having a broad, rounded main cusp and a well-developed ectocone, the marginal teeth much as in *Drymæus.* *Leiostracus.*

Genus AURIS Spix.

Manual x, p. 95. Type *A. melastoma.* *Pachyotus* of many authors.

Large, usually pale-colored *Bulimulidæ*, with the apex smooth, the peristome reflexed and generally bearing a flange or callosity upon the outer lip.

The genital system, jaw and teeth, present no well-marked or diagnostic characters differentiating this group from *Plekocheilus* or *Bulimulus.* It rests upon conchologic peculiarities.

Subgenus AURIS *s. str.*

The anatomy of *A. bilabiata* and *A. egregia* has been examined by Semper. There is a rather broad and long mantle-lobe extending along the whole left mantle-edge. The kidney is short, hardly longer than the pericardium; secondary ureter closed. The venation of the lung is confined to the neighborhood of the pneumostome.

The genital system (pl. 50, fig. 13, *A. egregia*, after Semper) is simple, the penis with terminal retractor and no papilla. At its base there is a circular muscle, embracing also the vas deferens, as in many *Bulimulus*. The small spermatheca is borne upon a long duct.

The jaw of *bilabiata* is composed of 13 unequal, broad, flat ribs, hardly projecting below. In *egregia* there is a very wide, smooth-edged median plait, with two broad ribs on each side, not produced on the cutting edge.

The radula has 61–63 teeth in *bilabiata*, 65–67 in *egregia*, the transverse rows being slightly angular in the middle. The middle tooth is tricuspid, median cusp wide; the laterals have a small ectocone and obtuse mesocone.

The jaw in this group is in a transition state from the plaited to the smooth type. The genitalia and teeth offer no differences of importance from those of *Eudolichotis*.

A. bilabiata B. & S., x, 99.
Helix maximiliana Fér.
var. melanostoma Mor., x, 101.
A. egregia Jay, x, 101.
var. nigrilabris Pils., x, 102.
A. melastoma Sw., x, 102.
B. melanostomus Dh.
B. struthiolaris Mke.
var. brachyplax Pils., x, 103.
A. icterostoma Mart., xiv, 132.
A. chrysostoma Mor., x, 103.
var. swainsoni Pfr., x, 104.
A. bernardii Pfr., x, 105.
A. illheocola Mor., x, 106.

Subgenus (?) OTOSTOMUS Beck, 1837.

Manual, x, p. 107.

The apex in this group is exactly like that of *Drymæus* and of the sections of *Odontostomus* grouping around the typical subgenus. Whether the group belongs to *Auris*, or is a distinct genus near the

Zaplagius group of *Drymæus*, will depend upon the soft anatomy; but I think likely that an examination of the jaw and teeth will show the latter location to be near the truth.

A. signata Spix, x, 107. Province of Bahia, Brazil.
Auris vittata Spix.

Subgenus Eudolichotis Pilsbry, 1896.

Man. Conch., x, pp. 98, 108. Type *A. distorta*.

The mantle of *A. distorta* has a very small anterior and two larger, widely separated left lobes. The kidney is even shorter than the pericardium. The genital system (pl. 50, fig. 7, after Semper) is simple, the long penis prolonged beyond the insertion of the vas deferens, with terminal retractor; duct of the spermatheca long.

The jaw of *A. distorta* has 35 plaits, the edges of which are hardly free; 5 or 6 median plaits converge and are coalescent, only the outer reaching the lower margin (*Semper*). That of *A. aurissciuri* (pl. 50, fig. 11, after Pace) is similar but with less converging and with fewer plaits. It is like the jaw of *Bulimulus*. The radula of *A. distorta* has 100–108 teeth in the slightly V-shaped rows. The median tooth has a long lanceolate cusp; first lateral tooth is similar with a small ectocone, the rest having more rounded cusps and larger ectocones (pl. 50, fig. 14, a central with 1st, 2d, 17th and 25th teeth, after Semper).

A. distorta Brug., x, 109.
var. sublævis Pils., x, 111.
var. gracilis Pils., x, 111.
var. guairensis Jouss., x, 111.
var. bisuturalis Pils., x, 112.
A. aurissciuri Gp., x, 112.
B. aegotis Pfr.
A. glabra Gm., x, 113.
Voluta auris Judæ Meusch., xiv, 133.
H. auris-caprinus Fér.
P. caprinus Bk.
Pupa auris sileni Gray.
Auricula sileni Lam.
A. glabra Gmel.
Pelek. undulatus Bk.
Bul. aegotis Mke.
var. grenadensis Gp., x, 114.
A. lacerta Pfr., x, 115.
A. sinuata Alb., x, 116.
A. euryomphala Jon., x, 116.
B. otostomus Pfr.
A. perdix Pfr., x, 118.
A. dillwyniana Pfr., x, 118.
A. midas Alb., x, 119.
var. spectrum Alb., x, 119.
A. hauxwelli Crosse, x, 120.

Genus PLEKOCHEILUS Guilding, 1828.

Man. Conch. x, p. 62.

Shell ovate, usually solid and opaque and zigzag-streaked or dappled with brown. Aperture large, ovate, the peristome expanded, reflexed or blunt, columella bearing a fold, or simple.

There are two small, well-separated frontal lobes on the left side of the mantle. Kidney (of *P. blainvilleanus*) very short, triangular, not projecting beyond the pericardium.

Genitalia (*P. blainvilleanus*, pl. 50, fig. 3, after Semper): Atrium very short; penis moderately long, continued in a long epiphallus which terminates in the vas deferens and a long flagellum; "retractor muscle inserted about the middle." Vagina short and wide. Spermatheca globular, on a very long duct, as long as the oviduct. (The penis is shown exserted in the figure). Jaw arcuate, composed of numerous delicate plaits, 41 in *P. blainvilleanus* (pl. 50, fig. 4, after Schako), about 60 in *P. aulacostylus*.

Radula broad, the rows of teeth widely V shaped (pl. 50, fig. 12, *P. blainvilleanus*), composed of 62,1,62 x 110 teeth (*blainvilleanus*, pl. 50, figs. 5, 6). In this species the basal-plates are longer than the cusps; central tooth with a stout middle cusp, side cusps small; laterals similar but with no inner cusp; marginals irregularly denticulate. In *P. aurissileni* and *P. aulacostylus* (pl. 50, figs. 9, 10, after Binney) the mesocones are long and acute, reaching beyond the basal-plate; in the former the side-cusps are sub-obsolete, in the latter well developed.

Type, *P. aurissileni* (Born).

Distribution: Northwestern South America, St. Vincent and St. Lucia.

My knowledge of the soft anatomy of this genus is from the work of Semper, Binney and Schako. It agrees in all respects with *Bulimulus* except that Semper states that there is a flagellum on the penis. This seems to me very doubtful. The structure he figures may rather be the retractor muscle of the penis. The rank of *Plekocheilus* as a genus rests upon its conchological peculiarities.

Section *Plekocheilus s. str.*

Man. Conch., x, p. 64.

Shell wrinkled or malleate, the spire costulate.

P. aurissileni Born, x, 65.
Auricula caprella Lam.
Carychium undulatum Leach.
Plekocheilus sileni Beck.
P. fulminans Nyst, x, 66.
Bulimus bellulus Jonas.
var. linterae Sowb., x, 67.
P. blainvilleanus Pfr., x, 67.
var. loveni Pfr., x, 67.
P. lugubris Dkr., x, 68.
P. appuni Dkr., x, 68.

Section *Eurytus* Albers, 1850.

Man. Conch., x, p. 69. Type *P. pintadinus* (Orb.).
Shell granose or striate, rarely almost smooth.

Group of P. speciosus.

P. speciosus Pfr., x, 70.
P. plectostylus Pfr., x, 70; xiv, 129.
P. guentheri Sowb., xiv, 129.
B. guildingi Dohrn, x, 71, preoc.

Group of P. aulacostylus.

P. aulacostylus Pfr., x, 72. St. Lucia.
B. lentiginosus Redf.

Group of P. coloratus.

P. roseolabrum Sm. x, 73.
P. eros Angas, x, 74.
P. coloratus Nyst, x, 74, 198; xiv, 129.
var. lamarckianus Pfr., x, 75.
var. ampullaroides Mss., x, 75.
var. subplicatus Pfr., xiv, 130.
P. gibbonius Lea, x, 75.
B. gibboreus, Pfr.-Cless., xiv, 127.
P. doliarius DaC., xiv, 130.
P. episcopalis Pfr., x, 76.
P. corticosus Sowb., x, 76.
P. cardinalis Pfr., x, 77.
P. tetensi Dkr., x, 77.
P. couturesi Anc., xiv, 131.
P. pulicarius Rve, x, 78.
B. glandiformis, Pfr.
P. glandiformis Lea, x, 78.
P. mabillei Crosse, x, 79; xiv, 127.
P. subglandiformis Mss., x, 80.
P. corydon Crosse, x, 80.
P. phoebus Pfr., x, 81.
P. taquinensis Pfr., x, 81.

Group of P. succinoides.

P. cathcartiæ Rve., x, 82.
P. (?) victor Pfr., x, 82.
P. jucundus Pfr., x, 82.
P. quadricolor Pfr., x, 83.
P. dalmasi Dautz., xiv, 128.
P. argenteus Jouss., xiv, 128.
P. veranyi Pfr., x, 83.
var. scytodes Pfr., x, 84.
sytodes Ads., x, 199.
P. succinoides Pet., x, 84; xiv, 128.
B. succineoides Mart.
Succinea bulimoides Pfr.
B. latilabris Pfr.
P. calliostoma Dohrn, x, 85.

Group of P. castaneus.

P. castaneus Pfr., x, 85; xiv, 131.
P. elaeodes Pfr., x, 86.
P. aristæus Crosse, x, 88, 199.
P. jimenezi Hid., x, 86, 199.
B. gibbonius Hid. *olim.*

Group of P. taylorianus.

P. piperitus Sowb., x, 89.
P. pulicarius Bk., xiv, 132.
P. piperatoides Pils., xiv, 132.
P. pseudopiperatus Mor., x, 89.
P. taylorianus Rve., x, 90; xiv, 132.
E. taylorioides Mill.
P. superstriatus Sowb., x, 91.
var. prodeflexus Pils., x, 91.
P. aureonitens Mill., x, 91.
P. tricolor Pfr., x, 87; xiv, 131.
var. semipictus Hid., x, 87.
? *Simpulopsis fulgurata* Mill., xii, 227.

Group of P. floccosus.

P. floccosus Spix, x, 92.
P. lacrimosus Heimb., x, 199.
P. pintadinus Orb., x, 93.
Helix pentadina Orb.
P. onca Orb., x, 93.
B. onza Alb.
P. lynciculus D. & H., x, 94.
P. semperi Dohrn, x, 94.

Genus THAUMASTUS Albers, 1860.

Thaumastus Alb., as restricted by Pilsbry, Man. Conch. x, p. 43, type *T. hartwegi* Pfr.—*Orphnus* Alb., preoc, type *B. taunaisii.*—*Orphaicus* Schaufuss, in Paetel's Catal. 1864, p. 14, proposed as a substitute for *Orphnus.*—*Tatutor* Jouss., 1887, type *T. tatutor.*

Shell rather large, narrowly umbilicate or imperforate, *long-ovate* with *lengthened spire* and blunt apex; moderately solid, *opaque,* usually dark, streaked, and generally having a light peripheral band. *Nepionic whorls* $2\frac{1}{2}$ *to* 3, *sculptured with fine vertical waved or inter-*

rupted wrinkles, or thimble-pitted by regularly anastomosing wrinkles. Aperture less than half the shell's length, ovate, the *outer lip obtuse, not expanded or but slightly so.* Columellar lip reflexed, usually adnate, the short columella with a weak fold or none.

Anatomy known from a specimen of *T. magnificus* from Piquete, Sao Paulo, Brazil, sent by Dr. H. von Ihering. The long lung is densely veined anteriorly, and posteriorly between the kidney and intestine (pl. 49, fig. 9, nat. size. The preparation figured has been extensively torn, as indicated). The kidney is triangular and as long as the pericardium. The secondary ureter is a closed tube throughout.

The genital system (pl. 51, fig. 19, nat size), is Bulimuline. The penis is enlarged in the middle (fig. 17), having very thick, muscular walls and a small lumen (*c*). It is contracted above, plicate within, and receives the vas deferens some distance below the apex (see fig. 17). The retractor muscle is terminal. The base is encircled by a sheath, within which a loop of the vas deferens descends (fig. 18). The vagina is short, plicate within. The duct of the spermatheca is very long, and becomes abruptly narrower in the middle (pl. 51, fig. 21); its lumen has finely plicate walls.

The jaw (pl. 57, fig. 60) is composed of about a dozen broad flat plaits, well consolidated.

The radula has 44, 1, 44 teeth (pl. 57, fig. 61). The centrals are tricuspid, laterals and marginal teeth bicuspid, of the ordinary Helicid type commonly occurring in *Bulimulus.* The splitting of the ectocone of tooth 18, figured, is somewhat abnormal.

In *T. foveolatus* Binney found the jaw with over 50 delicate ribs, teeth 34, 1, 34, without side cusps on centrals and laterals.

Distribution, southern Brazil and Bolivia to the head waters of the Amazon in Peru and Ecuador.

I formerly considered this group a subgenus of *Strophocheilus*, on account of its comparatively large nepionic shell; but the anatomy of *T. taunaisii* var. *magnificus* shows *Thaumastus* to belong near *Bulimulus*, *Auris* and *Plekocheilus.* It has nothing to do with *Strophocheilus.* The sculpture of the apex repeats patterns occurring in *Bulimulus.* The teeth, jaw and genitalia are Bulimuline in their main features. The reticulation of the lung is like that of *Auris egregia.*

The species fall into four groups, as follows:

a. Shell distinctly perforate or umbilicate.

b. Large, solid species, with spiral series of granules; three earlier whorls densely wave-striate; peristome expanded, subreflexed. *Group of T. melanocheilus.*

b[1]. Smaller, more slender forms, with coarser, very irregular or dislocated wrinkles on the early whorls; peristome but slightly or not expanded. *Group of T. bitæniatus.*

a[1]. Shell imperforate.

b. Early whorls finely and densely wave-striate longitudinally. *Group of T. taunaisii.*

b[1]. Early whorls thimble-pitted. *Group of T. thompsoni.*

Group of T. melanocheilus.

T. melanocheilus Nyst, x, 44.
T. sangoæ Tschudi, x, 45.
B. pangoæ Morel., x, 198.
T. granocinctus Pils., xiv, 126.
B. filocinctus Rolle.
T. foveolatus Rve., x, 46.
B. impressus Tschudi.

Group of T. taunaisii.

T. magnificus Grat., x, 46.
v. monozonalis Dh., x, 47.
T. tatutor Jouss., x, 47.
T. taunaisii Fér., x, 48.
? *Helix pullata* Fér.
T. ascendens Pfr., x, 49.
T. plumbeus Pfr., x, 49.
T. hector Pfr., x, 50.
T. largillierti Pfr., x, 50.
B. consimilis Rve.
T. achilles Pfr., x, 51.
v. nehringi Mart., x, 51.
T. hartwegi Pfr., x, 52, 198.
Zebra loxensis Miller.
T. loxostomus Pfr., x, 52.
T. salteri Sowb., x, 52.
T. thompsoni Pfr., x, 53, 198.
T. yanamensis Morel., x, 54, 198.
T. viriatus Morel., x, 54.
T. requieni Pfr., x, 55.

Group of T. bitæniatus.

T. spixii Wagn., x, 55.
? *B. hyalinus* Spix.
? *Bulinus sordidus* King.
T. inca Orb., x, 56.
T. tæniolus Nyst., x, 57.
T. brephoides Orb., x, 57, 198.
T. iserni Phil., x, 57, 198.
T. tarmensis Phil., x, 60.
T. bitæniatus Nyst, x, 58; xiv, 127.
B. bivittatus Phil.
B. bifasciatus Phil.
B. fusiformis Tschudi.
form *unicolor* Phil., x, 59.
v. alutaceus Rve., x, 59, 198.
v. jelskii Lub., x, 58.
T. porphyreus Pfr., x, 60, 198.
T. jaspideus Morel., x, 61.

Genus XENOTHAUMA Fulton, 1896.

This vol., p. 134. Type and sole species, *X. baroni*.

This is probably, as I have elsewhere noted, a *Scutalus* specialized in the whole structure of the post-nepionic shell; but so divergent that it deserves generic rank.

X. baroni Fult., xiv, 134. Peru.

Genus BULIMULUS Leach, 1815.

Man. Conch., x, p. 125. Type *B. guadalupensis* Brug.

Shell varying from ovate-conic to oblong, column-shaped, or rarely depressed and Helicoid; umbilicate or imperforate. Aperture with the outer lip usually thin, sometimes expanded. Columella straight or concave below, weakly folded above, the margin reflexed. Apical whorls variously sculptured (but never with an even, minute sculpture of pits in spiral and vertical series).

The mantle generally bears two widely separated lobes. The kidney is the length of the pericardium and triangular. The reticulation of the lung is chiefly along the intestinal side, spreading to the other side near the pneumostome. The pulmonary vein dominates, though sometimes the first branch of the vena cava is well developed (pl. 53, figs. 30 to 33).

The free retractors are typical of the family, the left tentacular and pharyngeal bands being more or less united proximally, and the right tentacular band arises from the face of the columellar muscle (pl. 54, fig. 39, *B. dealbatus*). As in other genera of the family, the columellar muscle is adnate throughout to the adjacent face of the mantle.

The genital system is simple. The penis is long and generally twisted, the vas deferens and retractor muscle arising from its apex; it is generally encircled around the base by a muscular sheath. The duct of the spermatheca is generally about as long as the oviduct. Some branches of the right tentacular muscle band are attached to the vagina and to the body-wall near the external opening.

The jaw is arcuate and plaited, the plaits vertical in the middle, not converging to form a triangular area (pl. 57, fig. 62, *B. dealbatus mooreanus*).

The radula has but slightly curved transverse rows of teeth, which are of the normal Helicid form. In the rhachidian teeth, the large mesocone usually is flanked by small etocones. The laterals have

the mesocone large, ectocone well developed. This type is continued in the marginal teeth (pl. 57, fig. 63, *B. limnoides*, after Binney; fig. 64, *B. dealbatus mooreanus*). Distribution, from the southern United States to northern Patagonia.

The genus *Bulimulus* is more widely distributed than any other group of the family. It is also the least specialized; the genera preceding being variously specialized in shell characters, those following chiefly in characters of the teeth and jaws. It is likely that the common ancestors of all *Bulimulidæ* were similar to *Bulimulus* both in internal structure and shells.

The multitude of subgeneric and sectional names which have been proposed for minor groups of Bulimuli fall into three main divisions.

I. Apical whorls smooth (p. xxiii.).

II. Apical whorls irregularly wrinkled subvertically, or with the wrinkles waved, dislocated, or broken into a thimble-pitted reticulation (p. xxvi.).

III. Apical whorls with regular, straight, vertical riblets (p. xxxii.).

Division I. *Bulimuli with smooth apical whorls.*

The shell varies from obesely ovate to slender and column-shaped, or rarely Heliciform, and from umbilicate to imperforate. It is usually *calcareous and opaque.* The *apical whorls are smooth* and glossy, without sculpture of any kind. Aperture ovate or angular, the outer lip usually thin and simple, rarely expanded. Columella foldless, dilated above.

A group of plain-colored or whitish species characteristic of the Pacific slope and Andean highland, from Ecuador to Chili; with a few thinner, corneous or brownish forms, referred here with some doubt, in Bolivia and Argentina.

The species have in common a small, *smooth*, often teat-like nepionic shell. The subsequent growth is widely divergent in various forms, and hence a large number of "sections" have been established, based upon the contour assumed by the adult shell—natural groups, but of only minor systematic value.

Section *Platybostryx* Pilsbry, 1896.

Depressed, wider than high, acutely keeled at the periphery and around the broad, crater-shaped umbilicus.

B. eremothauma Pils., x, 129. Chili.

Helix reentsii Phil., preoc.

Section *Ataxas* Albers, 1850.

Long-conic, with 7–11 whorls coiled around a large, deep umbilicus. Type *B. umbilicaris*. Peru.

B. umbilicaris Soul., x, 130.
B. infundibuliformis Jay.
B. infundibulum Pfr., x, 131.
v. umbilicatellus Pils., x, 131.
B. tubulatus Morel., x, 132.
B. huayaboensis Dautz., J. de C., 1902.
v. attenuata and rudis.
B. moniezi Dautz, xiv, 136.
f. albescens Dautz.
B. scalaricosta Morel., x, 132.

Section *Bostryx* Troschel, 1847.

Turreted, wrinkled, the last whorl or two free or separated by deep sutures; umbilicus inconspicuous. Type *B. solutus*. Peru, Chili.

B. solutus Trosch., x, 133.
B. holostoma Pfr., x, 134.

Section *Geopyrgus* Pils., 1896.

Turreted, *tapering*, rimate, composed of 9–10 whorls. Peru.

B. turritus Brod., x, 135, 200.

Section *Geoceras* Pilsbry, 1896.

Column-shaped, composed of 16–19 narrow whorls. Type *B. columellaris*. Andes of Peru.

B. columellaris Rve., x, 136.
B. cuspidatus Morel., x, 137.
B. veruculum Morel., x, 137.

Section *Peronæus* Alb., 1850.

Rimate or perforate, long-fusiform, slender, with 7–11 whorls. Type *B. pupiformis*.

(*Group of B. pupiformis*. Chili, Peru.)

B. pupiformis Brod., x, 138.
B. anachoreta Pfr., x, 139.
B. lactifluus Pfr., x, 140.
B. atacamensis Pfr., x, 140.
B. longurio Crosse.
B. nanus Rve., x, 141.
B. leucostictus Phil., x, 141.
B. scabiosus Sowb., x, 142.
B. terebralis Pfr., x, 142.
B. bisculptus Pfr., x, 142.
B. baeri Dautz., xiv, 135.
B. iocosensis Dautz., xiv, 135.
B. emaciatus Morel., x, 143.
B. spiculatus Morel., x, 144.
B. acromelas Morel., x, 144.
B. lichenorum Orb., x, 145.
lichnorum Orb.
lichenum Beck.
B. subcactorum Pils., x, 145.
B. tschudii Trosch., x, 146.

(*Group of B. williamsi.* Peru, Argentina.)

B. williamsi Pfr., x, 146.
B. peliostomus "Phil." Pfr., x, 147.
B. andiocus Morel., x, 147.
B. productus Phil., x, 148.
B. albicolor Morel., x, 148.
B. lesueureanus Mor., x, 149.
B. hamiltoni Rve., x, 149.
B. elatus Phil., x, 150.
B. ceratacme Pfr., x, 150.
B. biformis Pfr., x, 151.
B. woodwardi Pfr., x, 151.
B. calchaquinus Doer., x, 151.
B. famatimus Doer., x, 152.

(*Group of B. rhodacme.* Chili, Peru.)

B. rhodacme Pfr., x, 152.
B. pustulosus Brod., x, 153.
B. scalarioides Ph., x, 154.
B. voithianus Pfr., xi, 322.
boithyanus Ads.
meridionalis Rve.
feisthameli Hupé.

Section *Lissoacme* Pils., 1896.

Obese or ovate, umbilicate or perforate. Type *B. erythrostomus.*

(*Group of B. reentsi.* Chala, Peru.)

B. reentsi Phil., x, 155.
B. reentzi Schauf.
B. denickei Gray.
B. deneckei H. & A. Ad.

(*Group of B. hennahi.* Chili to Ecuador.)

B. styliger Beck., x, 156.
B. vittatus Brod.
B. lemniscatus Dh.
B. hennahi Gray, x, 156.
rubescens Rve.
lychnorum Sowb.
cactorum Orb.
virginalis Morel.
B. metamorphus Pils., x, 157.
B. limensis Rve., x, 158.
B. ceroplasta Pils., x, 159.
B. acalles Pfr., x, 160.
B. erosus Brod., x, 160.
B. conspersus Brod., x, 160.
B. coagulatus Rve., x, 161.
B. modestus Brod., x, 161.
striatulus Sowb.
orbignyi Pfr.
B. delicatulus Phil., x, 162.
B. sordidus Less., x, 163.
B. guttatus Brod., x, 163.
B. juana Cousin, x, 164.
B. laurentii Sowb., x, 164.
lorenzii Orb.
B. scutulatus Brod., x, 165.
B. limonoicus Orb., x, 165.
cinereus Rve.
B. depstus Rve., x, 181; xiv, 136.
flagellatus Pils., x, 166.
B. andicola Pfr., x, 166.
B. ulloæ Phil., x, 167.
B. apertus Pfr., x, 168.
B. (?) tumidulus Pfr., x, 168.
Bulinus inflatus Brod.
B. scalariformis Brod., x, 169.
B. rusticellus Mor., x, 170.
B. devians Dohrn, x, 170.
B. compactus Fult., xiv, 282.

(*Group of B. derelictus.* Chili, Ecuador.)

B. derelictus Brod., x, 172.
B. curtus Koch.
B. umbilicatus Mill., x, 172.
Prov. Loja, Ecuador.

(*Group of B. erythrostomus.* Chili.)

B. erythrostomus Sowb., x, 173.
v. albus Sowb., x, 174.
olorinus Ducl.
B. huascensis Rve., x, 174.
B. albicans Brod., x, 175.
spixii Pot. & Mich.
B. pruinosus Sowb., x, 175.
B. rouaulti Hupé, x, 176.
B. simpliculus Pfr., x, 176; xiv, 137.
B. mejillonensis Pfr., x, 177.
callosus Phil.
mexilloensis Schauf.
B. affinis Brod., x, 177.
v. paposensis Pfr., x, 178.
B. callosus Pfr., x, 178.
B. pervius Pfr., xiv, 139.

(*Group of B. striatus.* Peru, Ecuador.)

B. striatus King, x, 179.
Buliminus striatellus Bk.
B. piuranus Alb., x, 180.
B. alausiensis Cousin, x, 180.
B. delumbis Rve., xiv, 138.
B. nigropileatus Rve., x, 182; xiv, 137.
v. stenacme Pfr,, x, 182.
v. angrandianus, Pils., xiv, 137.
radiatus Morel., x, 182.
v. orophilus Morel., x, 183.
v. balsanus Morel., x, 184.
v. reconditus Rve., x, 181.
B. cereicola Morel., x, 184.
cercicola Morel.
B. munsteri Orb., x, 185.
B. cambus Gray.
B. bilineatus Sowb., x, 187.

(*Group of B. apodemetes.* Argentina, Bolivia.)

B. apodemetes Orb., x, 187.
pessulatus Rve.
B. centralis Doer., x, 188.
B. ventanensis Pils., x, 189.
B. conospirus Doer., x, 189.
B. oxylabris Doer., x, 190.
B. stelzneri Dohrn, x, 190.
B. fayssianus Pet., x, 192.
B. turritellatus Bk., x, 193.
Helix turritella Orb.
v. pliculosa Anc., xiv, 139.
? B. luridus Pfr., x, 194.
Habitat unknown.

DIVISION II. *Bulimuli with the nepionic whorls sculptured with waved, zigzag or irregular subvertical wrinkles, or with the wrinkles dislocated and broken more or less into granules, or anastomosing to form a netted or thimble-like pattern.*

This group of forms inhabits temperate and tropical South America, the Antilles and southern Mexico. The shell is ovate, less varied in form than in the preceding and following divisions.

Subgenus Plectostylus Beck, 1837.

Manual xi, p. 2. In *B. chilensis* Semper found two small, widely separated body-lobes on the left margin of the mantle. The kidney is of the usual short, triangular form; genitalia simple, the penis with terminal retractor, spermatheca lying near the heart, on a long duct. The jaw is broad, strongly but irregularly ribbed. Radula with at least 101 teeth in a transverse row, the central tooth with short middle and obsolete side cusps, inner 14 laterals bicuspid, the inner cusp then appearing. Binney, who examined the same species, agrees as to the teeth. The rather strong development of the inner cusp gives the marginal teeth a strong resemblance to those of *Drymæus*. Type *B. peruvianus*. Almost wholly a group of the Chilian coastal region.

B. coturnix Sowb., xi, 3.

B. broderipii Sowb., xi, 4.
v. elongatus Orb., xiv, 140.

B. buschii Pfr., xi, 5.

B. variegatus Pfr., xi, 5.
rupicolus Rve.

B. moestai Dkr., xi, 6.

B. peruvianus Brug., xi, 7.
corrugatus King.
gravesi King.

B. punctulifer Sowb., xi, 317.

B. prolatus Gld., xi, 318.

B. chilensis Less., xi, 8.
Achatina chiliensis Less.
B. granulosus Pot. & Mich.
B. graniger Beck.
B. aldunatea Hupé.
Partula flavescens King.

B. reflexus Pfr., xi, 9.

B. ochsenii Dkr., xi, 10.
arbustorum Phil.

B. coquimbensis Brod., xi, 10.
v. perelegans Pils., xi, 11.
elegans Pfr.

B. filaris Pfr., xi, 316.
hilarus H. & A. Ad.

Subgenus Scutalus Alb.

Man. Conch. xi, p. 12.

The genital system in *B. proteiformis*, *proteus* and *versicolor* is simple, the penis and spermatheca duct long (pl. 52, fig. 29, *B. versicolor*, after Strebel). The jaw is strong, arcuate, with rather wide plaits, not imbricating (pl. 59, fig. 5, *B. proteus*, after Strebel). Radula with 90 to 96 teeth in a transverse row in *B. proteiformis*,

103 to 107 in *B. proteus*. The rhachidian and inner lateral teeth have no ectocones, an ectocone appearing on the 17th or 18th lateral. The marginal teeth are bicuspid (pl. 59, fig. 2, *B. proteiformis*, after Semper).

(*Group of B. proteus.* Peru.)

B. proteus Brod., xi, 13; xiv, 140.
sordidus Dh.
B. mutabilis Brod., xi, 14.
sordidus Rve.
B. proteiformis Dohrn, xi, 14.
B. coræformis Pils., xi, 15; xiv, 142.
B. cretaceus Pfr., xiv, 141.
B. baroni Fult., xi, 172; xiv, 142.
B. steerei Pils., xiv, 140.
B. versicolor Brod., xi, 16.
varians Küster.
v. callaoensis Pils., xi, 16.
B. aquilus Rve., xi, 17.
? B. mercurius Pfr., xiv, 140.

(*Group of B. tupacii.* Andes of Peru and Bolivia.)

B. revinctus Hupé, xi, 17.
B. gayi Pfr., xi, 18.
B. tupacii Orb., xi, 19; xiv, 142.
B. thamnoicus Orb., xi, 19; xiv, 142.
B. pluto Crosse, xi, 20.
B. petiti Pfr., xi, 21.
B. purpuratus Rve., xi, 21.
B. weddelli Hupé, xi, 21.
B. nemorensis 'Ph.' Pfr., xi, 22.
B. angrandi Mor., xi, 23.
B. alauda Hupé, xi, 23.
B. nucinus Rve., xi, 24.

(*Group of B culmineus.* Andes of Peru and Bolivia.)

B. culmineus Orb., xi, 25.
jussieui 'Val.,' Pfr.
B. subjussieui Pils., xi, 26.
jussieui Hupé.
B. lithoicus Orb., x, 179.
culminans Rve.
B. pentlandi Rve., xii, 27.
B. edwardsi Mor., xi, 27.
B. badius Sowb., xi, 28.
B. polymorphus Orb., xi, 28, 320.
B. promethus Cr., xi, 28.
B. ferrugineus Rve., xi, 29.
B. peristomatus Doer., xi, 29.

(*Group of B. æquatorius.* Andes of Ecuador.)

B. æquatorius Pfr., xi, 30.
B. ochraceus Mor., xi, 31.
B. cotopaxiensis Pfr., xi, 31.
B. subfasciatus Pfr., xi, 32.
B. anthisanensis Pfr., xi, 32.
antisanensis Alb. Mart.
B. caliginosus Rve., xi, 33.
B. cousini Jouss., xi, 33.
B. quitensis Pfr., x, 158.
v. irregularis Pfr., xi, 34.
v. catlowiæ Pfr., xi, 34.

Subgenus BULIMULUS (restricted).

Man. Conch. xi, p. 35. Type *B. guadalupensis* Brug. Includes *Leptomerus* Albers.

The shell is rather small, brown or corneous-brown, rarely with a few wide bands; lip and columella simple.

The kidney is as long as the pericardium, and triangular. The venation of the lung is chiefly on the intestinal side, and is faint except for the pulmonary vein, which has no large branches (pl. 53, fig. 31, *B. guadalupensis*. The figure is diagrammatic and the veins on the cardiac side are represented too strong).

Genitalia (pl. 52, fig. 24, *B. guadalupensis*, form *acutus* Leach, from Guadalupe) characterized by the long and very much twisted penis, and the spermathecal duct, which is shorter than in other groups of *Bulimulinæ*, and *inserted upon the atrium*, there being no vagina. Other organs as usual. In a Porto Rican form identified as *fraterculus*, Pfeffer found the penis only moderately contorted and the spermathecal duct very long (Beiträge, v, p. 56). This agrees with Fischer's dissection of a specimen of *guadalupensis* from Pointe-à-Pitre (pl. 59, fig. 3) in which the duct of the spermatheca is very long. The penis is apparently provided with a flagellum, figured but not mentioned by Fischer. No flagellum is mentioned by Semper, who dissected a specimen from Barbados, and I think it undoubtedly a mistake.

The jaw is of the vertically plaited type, with 15–18 plaits, not converging in the middle. Radula characterized by tricuspid central teeth, the middle cusp very long, reaching over the margin of the basal plate. Laterals bicuspid (pl. 57, fig. 63, *B. limnoides*, after Binney).

Antillean Species.

B. guadalupensis Brug., xiv, 143.
H. exilis Gmel., xi, 37.
B. acutus Leach.
B. trifasciatus Leach.
B. rubrifasciatus Rve.
B. simplex Beck.
(?) *B. antiguensis* Gldg., Swains.
v. eyriesii Drou., xi, 39, 320.
fraterculus auct., xiv, 143.
B. nicholsi A. D. B., xi, 40.
B. riisei Pfr., xi, 41.
B. lehmanni Pfr., xi, 42.
B. limnoides Fér., xi, 42.
lymnoides Rve.
limnæoides Alb.
B. chrysalis Pfr., xi, 43.
B. semicinctus Pils., xi, 44.
B. lherminieri Fisch., xi, 44.
B. houelmontensis Cr., xi, 45.

B. fraterculus "Fér.," P. & M., xi, 46.
B. diaphanus Pfr., xi, 47.
B. martinicensis Pfr., xi, 47.
B. mazei Cr., xi, 48.
B. barbadensis Pfr., xi, 48.
fuscus Gldg.
(?) B. stenogyroides Gupp., xi, 49.
B. sepulcralis Poey, xi, 49.
urinarius Poey., *olim.*
(?) B. indistinctus Pfr., xi, 144.
monilifer Rve.

Central American Species.

B. inermis Morel., xi, 51.
B. coriaceus Pfr., xi, 51; xiv, 143.
behrendti, Pfr., *berendti* Pfr.
(?) B. umbraticus Rve., xi, 52; xiv, 144.
B. unicolor Sowb., xi, 53.
v. istapensis C. & F., xi, 53.
v. petenensis Morel., xi, 54.
B. corneus Sowb., xi, 54.
v. nubeculatus Pfr., xi, 55
v. minor Mart., xi, 56.
B. sarcodes Rve., xi, 56.
B. dysoni Pfr., xi, 56.
v. ignavus Rve., xi, 57.

Species of Northwestern South America.

B. dysoni Pfr., xi, 57; xiv, 144.
B. buenavistensis Pils., xi, 59.
corneus Lea.
B. juvenilis Pfr., xi, 59.
B. cacticolus Rve., xi, 60.
B. erectus Rve., xi, 60.
B. marmatensis Pfr., xi, 61.
B. hyaloideus Pfr., xi, 61.
B. glandiniformis Sowb., xi, 61.
B. krebsianus Pils., xi, 62.
B. hachensis Rve., xiv, 144.
B. fontainii Orb., xi, 62.
B. ucayalensis Cr., xi, 63.
B. molecillus Rve., xi, 63.

Species of N. E. South America to Argentina.

Argentine species described by Doering and Strobel are of uncertain position, and may belong here or to *Lissoacme* (page xxvi).

B. orthodoxus Dr., xi, 64.
B. eganus Pfr., xi, 64.
B. tenuissimus Orb., xi, 64, 320.
thoreyi Beck.
B. puellaris Rve., xi, 66.
B. gorritiensis Pils., xi, 66.
B. sporadicus Orb., xi, 67.
subtropicalis Doer.
v. bonariensis Strob., xi, 68.
v. montevidensis Pfr., xi, 68.
gelidus Rve.

B. corumbaensis Pils., xi, 68.
amœnus Bonnet.
B. vesicalis Pfr., xi, 69.
v. uruguayanus Pils., xi, 69.
B. rushii Pils., x, 70.
B. mendozanus Strob., xi, 71.
v. bonaerensis Doer., xi, 319.
v. azulensis Doer., xi, 319.
B. tortoranus Doer., x, 192.
B. cordilleræ Strob., x, 191
B. monticola Doer., x, 191..
B. aguirrei Doer., xi, 320.
B. fourmiersi Orb., xi, 71.
B. simplex Hupé, xi, 72.
B. heloicus Orb., xi, 72.
B. nivalis Orb., xi, 72.
B. plicatulus Pfr., xi, 72.
pliculatus Pfr.-Cless.
B. castelnaui Pfr., xi, 73.
B. luteolus Anc., xiv, 145.
B. stilbe Pils., xiv, 145.
B. dukinfieldi Melv.., xiv, 146.
B. marcidus Rve., xiv, 146.

Habitat unknown.

B. indistinctus Pfr., xiv, 144.
monilifer Rve.
B. transparens Rve., xi, 73.
B. inutilis Rve., xi, 73.
B. haplochrous Pfr., xi, 74.

Section *Dentaxis* Pilsbry, 1902.

Cylindric-tapering, the nepionic shell with slight waved wrinkles and stronger spiral striæ ; columella bearing a tooth-like fold ; outer lip thin and unexpanded.

B. dentaxis Pils., xiv, 143. Peru.

Section *Rhinus* Albers, 1860.

Nepionic whorls finely and densely zigzag striate or with interrupted waved striæ, the cuticle elsewhere hairy or bristly in spiral lines. Type *B. heterotrichus.*

The jaw of *B. constrictus*, examined by Schako, is composed of 11 wide plaits. The radula has 27, 1, 27 teeth, in rows straight in the middle, a little arcuate at the ends; centrals tricuspid, laterals bicuspid ; both radula and jaw agreeing with those of *Bulimulus s. str.*

All of the species are Brazilian except *B. constrictus*, from Venezuela, and *argentinus*, from Entre-rios.

B. heterotrichus Moric., xi, 75.
(?) *Helix tumida* Gmel.
v. subtenuis Pils., xi, 76.
B. velutinohispidus Moric., xi, 76.
hirtus Beck.
B. longiseta Moric., xi, 77.
B. scobinatus Wood, xi, 77; xiv, 147.
B. ciliatus Gld., xi, 78.
B. koseritzi Cless., xi, 79.

B. sarcochilus Pfr., xi, 80.
B. constrictus Pfr., xi, 80.
tateanus Guppy.
angosturensis Grun.
B. pubescens Moric., xi, 81.
B. argentinus Anc., xiv. 147.
B. heterogrammus Mor., xi, 321.

DIVISION III. *Bulimuli with the nepionic whorls sculptured with regular, straight vertical riblets.*

Discontinuously distributed from the south-central United States southward to the Galapagos and Peru in the west, and Argentina in the east. Sufficient magnification usually shows delicate spiral striæ between the riblets of the nepionic shell. In *Neopetræus* and *Drymæus* this sculpture becomes far more strongly developed. The shell is dull, brown or white, sometimes streaked but very rarely banded. The contour varies from ovate to pillar-shaped. The sections are separated chiefly by their geographic distribution, and merely stand for groups of species of common ancestry, none of which have diverged much structurally from the precursor of the entire series.

Section *Protoglyptus* Pils., 1897.

Man. Conch. xi, p. 84.

A group of northern and eastern South America, extending into some of the Caribbean islands. The Peruvian species are whitish and calcareous; the others are thin, brown or corneous, and frequently hairy. Binney found the jaw and teeth of *B. durus* similar to those of typical *Bulimulus*.

B. pilosus Guppy, xi, 85.
B. sanctæluciæ Sm., xi, 86.
v. luciæ Pils., xi, 86.
B. chrysaloides Pils., xi, 87.
B. durus Spix, xi, 87.
B. ovulum Rve., xi, 88.
B. pachys Pils., xi, 88.
B. eudioptus Pils., xi, 89.
B. montivagus Orb., xi, 90.
cutisculptus Anc., xiv, 147.
v. chacoensis Anc., xiv, 147.
B. pollonerae Anc., xiv, 148.
B. crepundia Orb., xi, 90.
constrictus Rve.
redditus Rve.
B. rivasii Orb., xi, 91.
B. trichodes Orb., xi, 92; xiv, 148.
B. exornatus Rve., x, 171; xiv, 137, 282.
* * * * *
B. pileiformis Moric., xiv, 149.
* * * * *
B. glyptocephalus Pils., xi, 93.
B. sarcochrous Pils., xi, 93.
B. hæmatospira Pils., xiv, 149.

Section *Næsiotus* Albers, 1850.

Næsiotus Alb., Die Heliceen, p. 162, + *Rhaphiellus* Pfr. + *Pelecostoma* Reibisch (in part). Man. Conch., xi, p. 94.

A group of rather small species, including all *Bulimulidæ* of the Galapagos Islands. The surface is frequently wrinkled and generally striate spirally.

The genital system (pl. 59, fig. 6, *B. nux*, after Binney) is simple, penis long and slender, with terminal vas deferens. The duct of the ovate spermatheca is about as long as the penis, much shorter than the oviduct, and arises from the atrium. The jaw is composed of numerous flat plaits, 12 in *B. bauri* to 18 in *B. nux*, and is similar to that of typical *Bulimulus*. The radula has 15.9.1.9.15 teeth in *B. bauri*, 13.9.1.9.13 in *B. eschariferus* var. *ventrosus*, 31.9.1.9.31 in *B. nux*. The teeth (pl. 59, fig. 8, *B. bauri*, after Dall) are essentially alike in many species examined, the centrals being tricuspid, with the middle cusp large, as long as the basal plate; laterals bicuspid. The marginal teeth have a long, bifid inner cusp, and the *outer cusp is split into several denticles.* In this last character only does *Næsiotus* differ from typical *Bulimulus* in what is known of the soft anatomy, though the duct of the spermatheca is somewhat shorter than usual in *Bulimulus*. The splitting of the outer cusp indicates terrestrial rather than arboreal feeding.

B. achatellinus Fbs., xi, 99.
achatinellinus Pfr.
achatinellus Ads.
B. nux Brod., xi, 100.
nuciformis Petit.
v. incrassatus Pfr., xi, 102.
v. verrucosus Pfr., xi, 102.
v. asperatus Alb., xi, 102.
invalidus Reib.
B. approximatus Dall, xiv, 150.
B. rugulosus Sowb., xi, 103.
v. infuscatus Anc., xi, 103.
v. nudus Reib., xi, 103.
B. planospira Anc., xi, 104.
B. ustulatus Sowb., xi, 104.
venustus Reib.
B. calvus Sowb., xi, 105.
B. nucula Pfr., xi, 106.
B. galapaganus Pfr., xi, 107.
B. eschariferus Sowb., xi, 108; xiv, 152.
rugulosus Rve.
bizonalis Anc.
subconoidalis Anc.
v. pileatus Dall, xi, 109.
v. ventrosus Reib., xi, 109.
B. perspectivus Pfr., xi, 110.
rugulosus Reib.
B. snodgrassi Dall, xiv, 150.

B. jacobi Sowb., xi, 111; xiv, 151.
(?) *avellana* Beck.
v. pallidus Reib., xi, 112.
v. cinereus Reib., xi, 112.
vermiculatus Dall.
B. olla Dall, xi, 113.
jacobi Rve.
B. tanneri Dall, xi, 113; xiv, 152.
funneri Dall.
B. duncanus Dall, xi, 114; xiv, 152.
B. darwini Pfr., xi, 115.
manini Cpr.
B. wolfi Reib., xi, 115.
B. hoodensis Dall, xiv, 151.
B. unifasciatus Sowb., xi, 116.
B. simrothi Reib., xi, 117.
tortuganus Dall.
B. bauri Dall, xi, 118.
B. amastroides Anc., xi, 118.
B. curtus Reib., xi, 119.
anceyi Dall.
B. canaliferus Reib., xi, 119.
B. sculpturatus Pfr., xi, 120.
B. rugiferus Sowb., xi, 121.
B. nesioticus Dall, xi, 122.
B. reibischi Dall, xi, 122.
B. indefatigabilis Dall, xiv, 152.
B. habeli Stearns, xi, 123.
terebra Reib.
B. chemnitzioides Forbes, xi, 124.
lima Reib.

Section *Orthotomium* Crosse and Fischer.

Manual xi, p. 125.

The mantle has two short, widely separated lobes, with another near the anal orifice (pl. 53, fig. 32, *B. montezuma*).

The kidney and lung are as usual in the subfamily; the venation of the latter being confined to the area between the last fold of the gut and the pulmonary vein, and anteriorly on the cardiac side as far as the first branch of the vena cava. Elsewhere the venation is very slightly developed (pl. 53, fig. 30, *B. dealbatus;* fig. 33, *B. montezuma*, both double natural size).

The muscles are as usual in the family (pl. 54, fig. 39, *B. dealbatus*).

Genitalia. The long penis is moderately twisted, bears the retractor muscle at the apex, the vas deferens at or near it, and is encircled by a muscular sheath at the base. The vagina is moderately long; the spermatheca oval or globose, on a duct fully as long as the oviduct (pl. 52, fig. 23, *B. dealbatus;* fig. 25, *B. montezuma*, double natural size; fig. 28, *B. pallidior*, three times natural size).

The jaw is arcuate, bearing flat plaits which do not imbricate, and

are parallel in the middle (pl. 57, fig. 62, *B. d. mooreanus*). The radula (pl. 57, fig. 64, *B. d. mooreanus*), as in typical *Bulimulus*, the lateral and marginal teeth being bicuspid, centrals with small or subobsolete ectocones.

Distribution, Central and Northern Mexico, Lower California, and the Southwestern United States.

Group of B. alternatus. N.-E. Mexico, Texas to Ky.

B. durangoanus Mart., xi, 127.
B. dealbatus Say, xi, 128; xiv, 152.
liquabilis Rve.
confinis Rve.
v. nigromontanus Dall, xi, 128.
v. ragsdalei Pils., xi, 129.
v. pasonis Pils., 1902.
v. mooreanus 'WGB.' Pfr. xi, 130.
schiedeanus auct.
v. schiedeanus Pfr., xi, 131.
niveus Hegewisch.
candidissimus Nyst.
xanthostomus Wiegm.
v. patriarcha W. G. B. xi, 132.
B. alternatus Say, xi, 132; xiv, 152.
lactarius Mke.
v. mariæ Alb., xi, 133.
binneyanus Pfr.
galeottii Nyst.
albidus Taylor.

Group of B. sufflatus. Lower California.

B. sufflatus Gld., xi, 136.
vesicalis Gld.
juarezi Pfr.
v. insularis Coop., xi, 137.
v. chinchensis Coop., xi, 137.
B. recognitus Mab., xi, 137.
B. pilula W. G. B., xi, 138.
B. cooperi Dall, xi, 139.
B. decipiens Coop., xi, 139.
B. levis Dall, xi, 140.

Group of B. montezuma. Lower Cal.; Sinaloa.

B. excelsus Gld., xi, 141.
elatus Gld.
v. sinaloæ Pils., xi, 142.
B. pallidior Sowb., xi, 142.
vegetus Gld.
v. striatulus Dall, xi, 143.
vegexspiza Coop.
B. acholus Mab., xi, 143.
B. cosmicus Mab., xi, 144.
B. montezuma Dall, xi, 144.
proteus auct. Amer.
B. baileyi Dall, xi, 145.
B. gabbi C. & F., xi, 147.

Group of B inscendens. Lower California.

B. xantusi W. G. B., xi, 148.
B. digueti Mab., xi, 148.
B. beldingi Coop., xi, 149.
v. alta Dall, xi, 149.
v. monticola Dall, xi, 150.
B. cacotycus Mab., xi, 150.
B. inscendens W. G. B., xi, 150.

Section *Plicolumna* Cooper, 1895.

Vol. xi, p. 151. Slender and column-shaped. Distribution, Lower California.

B. artemisia W. G. B., xi, 152.
artemesia auct.
B. abbreviatus Coop., xi, 153.
B. ramentosus Coop., xi, 153.

Section *Sonorina* Pilsbry, 1896.

Leptobyrsus C. & F. not *Leptobyrsa* Stal. Columella bearing a strong, callous lamella within the last whorl. Distribution, Lower California.

B. rimatus Pfr., xi, 157.
bryanti Coop.
B. spirifer Gabb, xi, 158.
v. orthelasmus Pils., xi, 159.
B. lamellifer Pils., xi, 160.
B. veseyianus Dall, xi, 160.
B. lepidovagus Mab., xi, 161.
B. dentifer Mab., xi, 161.
B. dismenicus Mab., xi, 162.
B. subspirifer Mab., xi, 162.

Genus NEOPETRÆUS Martens, 1885.

Manual, xi, p. 163; xiv, p. 152. Type *N. millegranus* Mart.

This group is closely related to *Drymæus*, from which the shell differs in having the vertical riblets of the nepionic shell wider spaced and stronger than the spirals; though both are sometimes obsolete, leaving the apex smooth.

The jaw is like that of *Drymæus*, composed of 21 (*lobbi*, pl. 59, fig. 1, after Binney) to 31 (*altoperuvianus*) delicate imbricating ribs, which converge in the middle. The radula is broad, with numerous teeth in each row (90.1.90 in *N. lobbi*, pl. 59, fig. 9, after Binney). The centrals have a single long cusp; the laterals bear a very long, oblique, broad cusp, notched near the apex, the central and inner cusps being concrescent. The marginal teeth in *N. lobbi* have a large ectocone, and the united middle and inner cusps are shorter thus resembling the laterals of *Drymæus*, but in *N. altoperuvianus* (pl. 59, fig. 4, after Binney) the marginal teeth are of the same type as the laterals. The anatomy is otherwise unknown.

Distribution, Andes of Peru.

N. binneyanus Pfr., xi, 164.
N. vadum Pils., xi, 165.
N. filiola Pils., xi, 165.
N. cora Orb., xi, 166.
v. unicolor Pfr., xi, 167.
N. tessellatus Shutt., xi, 167.
v. atahualpa Dohrn, xi, 168.
v. perincrassatus Pils., xi, 169.
N. papillatus Morel., xi, 169.
N. catamarcanus Pfr., xi, 170.
N. millegranus Mart., xi, 170.
N. rhodolarynx Rve., xi, 171.
devillei Hupé.
N. platystomus Pfr., xi, 172; xiv, 153.
N. altoperuvianus Rve., xi, 173.
v. gracilior Pils., xi, 173.
(?) N. heterogyrus Phil., xi, 174.
N. sowerbyi Rve., xi, 174.
N. arboriferus Pils., xi, 175; xiv, 153.
f. rectistrigatus Pils., xi, 176.
f. latistrigatus Pils., xi, 176.
N. patasensis Pfr., xi, 176; xiv, 153.
N. lobbi Rve., xi, 177; xiv, 153.
v. ptychostylus Pfr., xi, 178.
N. decussatus Rve., xi, 178; xiv, 154.
v. myristicus Rve., xi, 178.
v. brownii Pils., xi, 179.
N. cœrulescens Pfr., xi, 180.
v. columna Pils., xi, 180.

Genus OXYCHONA Mörch, 1852.

Man. Conch. xi, p. 181. Type *O. bifasciata* Burrow.

Shell trochiform, with conspicuous peripheral keel, the nepionic whorls evenly latticed, as in *Drymæus*. Jaw composed of many vertical plaits, not converging in the middle. Radula with V-shaped rows of nearly similar teeth throughout, the middle cusps very large, spatulate; ectocones wanting on the central, present on the lateral teeth. Basal plates rather large and squarish (see vol. ix, p. 189, pl. 51, figs. 9, 10, 11, teeth and jaw of *O. bifasciata*). Genitalia unknown.

In the peculiar teeth of the radula, arranged in strongly V-shaped rows, *Oxychona* resembles *Zaplagius*. But in the latter group entocones are distinctly developed on all but the three inner lateral teeth, and the basal-plates are narrow. *Liostracus* has a somewhat similar dentition, owing to the wide mesocones; but the rows of teeth are nearly straight, and the structure of both basal-plate and cusps is more like normal *Drymæus*. In *Zaplagius* the outer marginal teeth are distinctly less modified than the rest of the radula, but in *Oxychona* the whole series is modified.

Species all of eastern Brazil, and evidently arboreal. The pertinence of *O. gyrina* Val. to *Oxychona* is doubtful, as neither the

apical sculpture or the dentition is known. It probably groups with *B. pileiformis* Moric.

O. bifasciata Burr., v, 129; xi, 181.
v. mimarum Anc., xiv, 154.
O. lonchostoma Mke., v. 130.
?O. gyrina Val., v, 131.

Genus ZAPLAGIUS Pilsbry, 1896.

Nautilus ix, p. 115, Feb., 1896; Man. Conch. xi, 185. Type *Helix navicula* Wagn.—*Navicula* Spix, 1827, not of Blainville, 1825.—*Otostomus* of some authors.

Shell conic or obliquely conic, with the apical sculpture of typical *Drymæus*, and a keel around the truncate or flattened base; the last whorl ascending, lip expanded or reflexed, thin.

Jaw deeply arched, with narrow plaits (43 in *aurisleporis*) converging mesially as in *Drymæus*.

Two widely separated lobes are on the left edge of the mantle. The kidney is the length of the pericardium (*Semper*).

The genital system (pl. 50, fig. 8, *Z. aurisleporis*, after Semper) is simple, the long slender penis having a terminal retractor, and the ovate spermatheca a long duct, as in *Bulimulus*, *Drymæus*, etc.

The radula (of *Z. aurisleporis*, pl. 58, figs. 70–74, from a specimen supplied by Dr. H. v. Ihering) has 37.1.37 teeth in V-shaped rows (pl. 58, fig. 74). The median tooth of each row has an exceedingly large, rounded cusp, the basal-plate being narrow except under the cusp. The lateral teeth have similar but subangular cusps, more or less emarginate near the inner side, indicating the concrescence of an entocone with the mesocone; and far back there is a minute, vestigeal outer cusp, remote from the main cusp, as in some *Urocoptidæ*. The fourth to sixth laterals show the entocone as a short prong, becoming stronger as we pass outward on the radula (fig. 70, 11th and 12th, and fig. 71, 21st and 22d teeth). The marginal teeth (pl. 58, fig. 73, 33d to 37th teeth) have a large mesocone, a retreating and distinct entocone, and the ectocone has traveled forward, become larger and usually bifid. They thus approximate to the marginals of typical *Drymæus*.

With the apical sculpture, jaw, and general anatomy of *Drymæus*, this group seems sufficiently specialized in dentition and shell to stand as a distinct genus. Its close relationship to *Oxychona* can hardly be doubted. The eastern Brazilian *Otostomus signatus* may also be related, but its soft anatomy is unknown.

Z. navicula Wagn., xi, 186.
N. fasciata Spix.
v. lateritius Pils., xi, 320.
Z. involutus Mart., xi, 187.
Z. uranops Pils., xi, 188.
Z. lateralis Mke., xi, 188.
Z. aurisleporis Brug., xi, 189.
B. lagotis Mke.
Auricula leporis Lam.
Stenostoma auritum Spix.
f. intensior Pils., xi, 190.
Z. aurismuris Moric., xi, 191.
Helix uniangulata Fér.

Genus DRYMÆUS Albers, 1850.

Drymæus Alb., Die Hel., p. 155, types *B. xanthostoma* and *B. hygrohylæus*.—Pilsbry, Manual, xi, p. 191.

In this group the shell is generally of lighter structure and brighter color than in *Bulimulus*. With the exception of the aberrant subgenus *Leiostracus*, all of the species have a characteristic pattern of apical sculpture, consisting of minute pits arranged with great regularity in spiral and vertical lines.

The external anatomy, free muscles, and pallial organs are practically identical with those of *Bulimulus* (pl. 54, fig. 40, *D. acervatus* Pfr., x 2). The secondary ureter is closed nearly to the end. The genital system is similar to that of *Bulimulus*.

The jaw is strongly arched, thin and flexible, composed of many narrow plaits, narrowly imbricating, and obliquely converging toward the median line, usually leaving a triangular plait or several short, wedge-shaped plaits in the middle. The lower or cutting margin is often more or less serrate (pl. 50, fig. 1, *D. virginalis*, after Schako; pl. 58, fig. 69, *D. acervatus*).

Radula rather broad, with a great number of teeth, 115 to over 150, in each transverse row. The rows are more or less angular in the middle, but not markedly V-shaped (pl. 50, fig. 2, *D. virginalis*, after Schako; pl. 58, fig. 75, *D. acervatus*, inverted).

The lateral teeth are oblique, tricuspid, the ento- and meso-cones more or less united basally; the ectocones become split upon the outer laterals and the marginal teeth. The rhachidian tooth varies widely, being tricuspid in some, unicuspid in other species (pl. 58, figs. 77, 79, *D. acervatus;* pl. 60, figs. 14, 15, *D. vincentinus;* pl. 60, fig. 16, *D. interpunctus*). In general, the lateral and marginal series of teeth are scarcely differentiated, all the side teeth being practically of one type. Distribution, tropical and subtropical regions of America, living chiefly on plants.

This genus is readily distinguished from *Bulimulus* by the sculpture of the apex (as in pl. 15, fig. 31). *Zaplagius*, *Oxychona*, *Otostomus*, *Odontostomus*, which have the same apical sculpture, differ in other conchological characters, as well as in dentition. The marginal teeth of *Plectostylus* resemble those of *Drymæus*, but in all other Bulimulid genera the form of the teeth is different. It will readily be understood that since the apical sculpture has rarely been mentioned in descriptions, a number of the species not known to me by specimens are placed in this genus provisionally, from their general resemblance to forms known to belong here. Previous to the discovery that the apical sculpture is correlated with a certain type of jaw and teeth, there was no definite criterion for the classification of the species of *Bulimulus* and *Drymæus*, although von Martens, Crosse and Fischer, W. G. Binney and Pfeffer had recognized that two diverse types of lingual armature were found among the species usually classified as *Bulimulus*.

The dentition deserves, and would well repay, an extended study. In some forms, such as *D. interpunctus* (pl. 60, fig. 16), there are excessively numerous and very minute teeth, in which the basal plate is so thin, and contains so small an amount of conchiolin, that it is scarcely or not visible. The rhachidian tooth has three cusps, the mesocone but slightly larger than the ectocones; and it is often perceptibly asymmetrical. The rows of teeth run *backward* each side of the middle, then turn forward (pl. 50, fig. 2). Radulæ of this type have been found in *D. interpunctus* (see pl. 60, fig. 16), *D. virginalis* (Schako), *D. dormani* (Binney), *palpaloensis* and *sulphureus* (Pfeffer). All of these are thin-shelled species with thin, simple peristome.

A modification of this type is seen in *D. laticinctus*, *immaculatus*, *bahamensis*, etc., in which the single broad cusp of the rhachidian tooth is notched (see Binney, Ann. N. Y. Acad. Sci. III, pl. 12, f. I. H. F.).

In another series the rhachidian tooth has a single rather narrow cusp (pl. 60, figs. 14, 15, *D. vincentinus*). The rows of teeth bend about as in *D. interpunctus*, but to a less extent, and more gradually.

In *D. acervatus* (pl. 58, figs. 75, 77, 79) the basal plates are less indistinct; the rhachidian tooth is tricuspid, the mesocone much longer than the blunt ectocones. The rows of teeth run slightly *backward* from the middle towards the margins, and are without the double sinuation described above.

In *Liostracus*, *Zaplagius* and *Oxychona* the rows of teeth run obliquely *forward* from the middle towards the margins, as in the *Orthalicinæ* and most other land snails which have oblique rows.

Group of D. inæqualis. N. Argentina to Ecuador.

D. abyssorum Orb. xi, 192 ; xiv, 154.
D. bolivarii Orb., xi, 193.
D. brachystoma Orb., xi, 193.
D. marmarinus Orb., xi, 194; xiv, 154.
D. hygrohylæus Orb., xi, 194; xiv, 154.
D. coarctatus Pfr., xi, 195.
D. schmidti Pfr., xi, 195.
coarctatus Rve.
D. xanthostoma Orb., xi, 196.
D. zoographicus Orb., xi, 197.
D. beyerleanus Hupé, xi, 197.
D. interpictus Mart., xi, 198.
D. inæqualis Pfr., xi, 199.
D. petasites Mill., xi, 199.
D. orthostoma Sm., xi, 200.
D. albolabiatus Sm., xi, 201.
D. fusoides Orb., xi, 201; xiv, 154.
D. lusorius Pfr., xi, 202.
D. lophoicus Orb., xi, 202.
D. feriatus Rve., xi, 203.
D. yungasensis Orb., xi, 203.
D. andai Jouss., xi, 212.
D. ochrocheilus Sm., xi, 204.
D. cantatus Rve., xi, 205.
D. peelii Rve., xi, 205; xiv, 154.
v. fordii Pils., xi, 205.
D. germaini Anc., xi, 206.
D. subeffusus Phil., xi, 217.
D. linostoma Orb., xi, 218.
D. serratus Pfr., xi, 218.
D. dacostianus Pils., xi, 219.
lucidus DaCosta.
D. baezensis Hid., xi, 219.
D. subsimilaris Pils., xi, 222.
D. æquatorianus Sm., xi, 220.
D. recedens Pfr., xi, 221.
D. eurystomus Ph., xi, 221.
D. elsteri DaC., xiv, 156.
D. jousseaumei Dautz. J. de C., 1901.
D. scoliodes Dautz. J. de C., 1901.

Species of Colombia and Venezuela.

D. violaceus Mouss., xi, 207.
eversus Mouss.
D. confluens Pfr., xi, 208.
D. baranguillanus Pfr., xi, 208.
D. flexuosus Pfr., xi, 209.
D. membielinus Cr., xi, 209.
D. cognatus Pils., xiv, 155.
D. hidalgoi DaC., xi, 210.
D. signifer Pfr., xi, 210.
D. felix Pfr., xi, 211.
D. elegantissimus Mss., xi, 211.
D. ziczac DaC., xi, 212.
D. bogotensis Pfr., xi, 212.
spectatus Rve., part.
D. spectatus Rve., xi, 213.
D. leai Pils., xi, 213.
gracilis Lea.
D. subventricosus DaC., xiv, 156.
D. exoticus DaC., xiv, 156.
D. dacostæ Sowb., xi, 214.

D. murrinus Rve., xi, 214.
v. phryne Pfr., xi, 215.
v. convexus Pfr., xi, 215.
D. antioquiensis Pfr., xi, 216.
D. muliebris Rve., xi, 216.
D. pealianus Lea, xi, 217.
D. inclinatus Pfr., xi, 221.

Group of D. expansus. Peru.

D. expansus Pfr., xi, 223; xiv, 155.
pulchellus Sowb.
iodostomus Dev. & H.
v. perenensis DaC., xiv, 156.
v. aurisratti Ph., xi, 223.
v. vanattai Pils., xi, 223.
v. scitus H. Ad., xi, 224.
v. subprotractus Pils., xiv, 155.
v. protractus Pfr., xi, 224.
D. bartletti H. Ad., xi, 224.
D. nigrogularis Dohrn, xi, 225.
D. puncticulatus Pfr., xi, 226.
D. hamadryas Ph., xi, 226.
D. crichtoni Brod., xi, 226.
D. narcissus Alb., xi, 227.
D. excoriatus Pfr., xi, 227.

Group of D. strigatus. Peru, Ecuador, Brazil.

D. strigatus Sowb., xi, 228; xiv, 158.
musivus Pfr. *musicus* Paetel.
f. purus Pils., saccatus Pfr., delphinæ, ceciliæ Moric., marieanus Pils. (*mariæ* Moric.)
D. arcuatostriatus Pfr., xi, 230.
strigatus Rve.
D. tigrinus DaC., xi, 231.
D. melanoscolops Dhn., xi, 231.
D. rectilinearis Pfr., xi, 232; xiv, 158.
D. gueinzii Pfr., xi, 233.
D. similaris Moric., xi, 233.
D. fucatus Rve., xi, 234.
D. aestivus Pfr., xi, 234.
D. geometricus Pfr., xi, 235.
D. clarus Pfr., xi, 235.
D. bucia "Behn" Pfr., xi, 235.

Group of D. orobænus. Bolivia, Peru.

D. orobænus Orb., xi, 236.
D. cuzcoensis Rve., xi, 236.
D. cygneus Ph., xi, 237.
D. membranaceus Ph., xi, 237.
D. prætextus Rve., xi, 238.

Group of D. fallax. Colombia, Ecuador. (*Semiclausaria* Pfr.)

D. subsemiclausus Pet., xi, 238.
D. rabuti Jouss., xi, 239.
D. fallax Pfr., xi, 239.
lautus Gld.
D. abscissus Pfr., xi, 240.
D. bourcieri Pfr., xi, 241.

Group of D. koppeli. Bogota.

D. koppeli Sowb. xi, 242.

Group of D. bivittatus. Ecuador.

D. bivittatus Sowb., xi, 242.
v. flexilabris Pfr., xi, 243.
D. quadrifasciatus Ang., xi, 243.
D. napo Ang., xi, 244.

Group of D. bolivianus. Peru to Colombia.

D. bolivianus Pfr., ix, 244.
D. subinterruptus Pfr., ix, 244.
D. lætus Rve., ix, 245.
D. trivittatus Mss., ix, 245.
D. tribalteatus Rve., ix, 246.
D. studeri Pfr., ix, 246.
v. primula Rve., ix, 247.
D. smithii DaC., xi, 247.
D. caucaensis DaC., xi, 247.
D. blandi Pils., xi, 248.
D. malleatus DaC., xi, 249.

Group of D. papyraceus. Brazil (*Mormus* Alb.).

D. papyraceus Mawe, xi, 250.
lita Fér.; *lituratus* Spix.
v. papyrifactus Pils., xi, 252.
? *latior* Martens.
D. polygrammus Moric., xi, 252.
D. cuticula Pfr., xi, 253.
D. magus Wagn., xi, 253.
inflatus Spix.
D. dutaillyi Pfr., xiv, 158.
D. henseli Mart., xi, 254.
D. acervatus Pfr., xi, 255.
f. balteatus Pils.
f. paucipunctus Pils.

Group of D. glaucostomus. Venezuela.

D. glaucostomus Alb., xi, 256.

Group of D. trigonostomus. Venezuela.

D. trigonostomus Jon., ix, 256.
curianianus Rve.
knorri Pfr.
D. trigonostomus.
v. correctus Pfr., xi, 258.
D. auris Pfr., xi, 259.

Group of D. chanchamayensis. Colombia to Peru.

D. chanchamayensis Hid., xi, 259.
canaliculatus var., Pfr.
D. fabrefactus Rve., xi, 260.
D. plicatoliratus DaC., xi, 260.
D. pulcherrimus H. Ad., xi, 260.
D. chimborasensis Rve., xi, 261.
D. decoratus Lea, xi, 261.
v. goniobasis Pils., xi, 262.

Group of D. nystianus. Ecuador, Peru, etc.

D. nystianus Pfr., xi, 262.
v. nigricans Cousin, xi, 263.
D. canaliculatus Pfr., xi, 263.
D. ambustus Rve., xi, 264.
v. chamæleon Pfr., xi, 264.
D. loxensis Pfr., xi, 265.
D. cactivorus Brod., xi, 265.
nitidus Brod.
nitidulus Beck.
occidentalis Mill.
D. decoloratus Sowb., xi, 266.
D. visendus Hid., xi, 267.

Group of D. farrisi. Peru and Ecuador.

D. chrysomelas Mart., xi, 267.
f. raristriga, crebristriga Mts.
D. farrisi Pfr., xi, 268.
D. vespertinus Pfr., xi, 269.
D. rubrovariegatus Higg., xi, 270.
D. loxanus Higg., xi, 270.
D. scitulus Rve., xi, 271.
v. citrinellus "Ph." Pfr., xi, 271.
D. edmulleri Alb., xi, 272.
D. trujillensis Ph., xi, 272.
D. lamas Higg., xi, 272.
D. sachsei Alb., xi, 273.
catamayensis Mill.
D. leucomelas Alb., xi, 274.
D. vexillum Wood, xi, 274; xiv, 159.
pulchellus Brod.
v. varians Brod., xi, 274.
v. rubellus Brod., xi, 275.
v. tigris Brod., xi, 275.
v. keppelli Pfr., xi, 296.
D. buckleyi Sowb., xi, 276.
D. lentiginosus Phil., xiv, 159.

Group of D. pœcilus. Argentina to Colombia.

D. coniformis Pfr., xi, 276.
D. oreades Orb., xi, 277.
D. pazianus Orb., xi, 277.
v. pseudonyma Pils., xi, 278.
montagnei Rve.
D. rocayanus Orb., xi, 321.
D. torallyi Orb., xi, 278.
ventricosus Par.
draparnaudi Pfr.
D. borellii Anc., xi, 279.
D. montagnei Orb., xi, 280.
castrensis Pfr.
D. stigmaticus Ph., xi, 281.
D. miliaris, Ph., xi, 281.
D. clathratus Pfr., xi, 281.
D. confusus Rve., xi, 282.
D. monachus Pfr., xi, 282.
D. canarius 'Ph.' Pfr., xi, 282.
D. morbidus Ph., xi, 283.
D. chenui, Ph., xi, 283.
D. subroseus Ph., xi, 284.
D. nigroapicatus Pfr., xi, 284.
D. alsophilus Ph., xi, 285.
D. pœcilus Orb., xi, 285.
præcilus Anton.
pictus Bonnet.
icterica Anc.
D. serenus Ph., xi, 285.
D. obliquestriatus DaC., xiv, 157.
D. cylindricus DaC., xiv, 157.
D. interpunctus Mart., xi, 287.
D. subpellucidus Sm., xi, 288.

D. flavidulus Sm., xi, 288.
D. fuscobasis Sm. xi, 289.
D. miltochrous Alb., xi, 290.
D. vestalis Alb., xi, 290.
D. anceps Alb., 290.
D. hepaticus Alb., xi, 291.
D. libertadensis Pils., xi, 291.
tæniatus Phil.
D. mexicanus Lam., xi, 291.
vittata Humb.
humboldtii Rve.
v. primularis Rve., xi, 292.
D. serotinus Morel., xi, 293.
D. longinquus Morel., xi, 293.
D. virgultorum Morel., x, 168; xi, 294.
D. dendritis Morel., x, 186.
D. bicolor Sowb., xi, 295.
D. paeteli Alb., xi, 295.
D. cerussatus Rve., xi, 296.
D. annulatus Rve., xi, 296.
bolivianus Rve.

Group of D. depictus. Colombia, Venezuela and Guiana.

D. semimaculatus Pils., xi, 297; xiv, 159.
maculatus Lea.
D. gereti Anc., xiv, 160.
D. semifasciatus Mss., xi, 298.
D. depictus Rve., xi, 299.
v. ictericus Mts., xi, 299.
v. pervariabilis Pfr., xi, 300.
D. granadensis Pfr., xi, 300.
D. incarnatus Pfr., xi, 300.
D. lividus Rve., xi, 301.
D. pertristis Pils., xi, 301.
tristis Pfr.
D. sanctæmarthæ Pils., xiv, 161.
D. roseatus Rve., xi, 301.
v. montanus Pils., xiv, 161.
D. lacteus Lea, xi, 302.
D. meridanus Pfr., xi, 303.
D. deshayesi Pfr., xi, 303.
D. dubius Pfr., xi, 303.
D. effeminatus Rve., xi, 304.
D. manupictus Rve., xi, 304.
D. fresnoensis Pils., xi, 304.
D. virgo Lea, xi, 305.
gruneri Pfr.
D. demerarensis Pfr., xi, 306.
D. demotus Rve., xi, 306.
feriatus Rve.
D. nigrofasciatus Pfr., xi, 307.
v. elongatulus Pils., xi, 307.
D. funeralis Brug., xiv, 160.
D. amœnus Pfr., xi, 308.
D. fidustus Rve., xi, 308.
D. rufolineatus Drou., xi, 308.
D. succinea Pils., xiv, 160.

Group of D. virginalis. Colombia, Venezuela.

D. virginalis Pfr., xi, 309.
D. electrum Rve., xi, 310.
D. tenuilabris Pfr., xi, 310.
D. flavidus Mke., xi, 310.
D. debilis Beck, xi, 311.
D. columbianus Lea, xi, 312.
D. venezuelensis Mart, xi, 312.
membranaceus Rve. & Mart.
D. gratus Pfr., xi, 313.
D. amandus Pfr., xi, 313.

SPECIES OF TRINIDAD, THE WEST INDIES AND FLORIDA.

D. dormani W. G. B., xii, 2.
v. albidus Wright, xii, 3.
subfasciatus Ckll.
D. dominicus Rve., xii, 3.
marielinus Poey.
floridanus Pfr.
hemphilli Wright.
D. hjalmarsoni Pfr., xii, 7.
D. moussoni Pfr., xii, 8.
D. bahamensis Pfr., xii, 8.
D. erubescens Pfr., xii, 9.
rufescens Gray.
D. immaculatus 'Ad.' Rve., xii, 10.
D. liliaceus Fér., xii, 10.
D. sallei Pils., xii, 11.
stramineus auct.
v. haitensis Pils., xii, 12.
bahamensis auct.
D. virginalis Pfr.
v. dominicanus Pils., xii, 12.
D. stramineus Gldg., xii, 13.
lucidus Rve.
v. fasciatus Sm., xii, 14.
D. multifasciatus Lam., xii, 14.
H. picturata Fér.
v. albicans Maze, xii, 16.
v. christopheri Pils., xii, 16.
D. laticinctus Gupp., xii, 16.
D. vincentinus Pfr., xii, 17.
v. flavotinctus Pils., xii, 18.
D. imperfectus Gupp., xii, 19.
trinitarius Smith.
D. aureolus Gupp., xii, 19.
D. rawsoni Gupp., xii, 20.
rawsonis H. Ad.
D. mossi Smith, xii, 21.
D. binominis Smith, xii, 21.
indistinctus Guppy.
v. lascellesianus Sm., xii, 22.
D. broadwayi Sm., xii, 22.
D. undulatus Gldg., xii, 22.
fluctuatus Beck.
D. elongatus Bolt., xii, 23.
virgulata Fér.
caribæorum Lam.
caraibæorum Bk.
f. ludovicus 'Rang' Pfr., xii, 26.
proteus Gldg., Swains.
rubra Pfr., *carnea* Mch.
f. anguillensis Pfr., xii, 26.
f. apiculatus Gray, xii, 26.
kämmereri Mörch.
f. extinctus Pfr., xii, 26.
D. multilineatus Say, xii, 27.
sisalensis Morel.
venosus Rve.
virgulatus A. Binney.
f. menkei Grun., xii, 28.
f. parvus Lea, xii, 29.

SPECIES OF MEXICO AND CENTRAL AMERICA.

Group of D. josephus.

D. zhorquinensis Ang., xii, 31.
pallidior Dall, part.
D. josephus Ang., xii, 32
f. maculosus Mart.
f. concolor Mart.
zeledoni Dall.

Group of D. serperastrum.

D. dombeyanus Fér., xii, 33.
Lymnœa rugosa Val.
f. alcantaræ Bern.
D. fenestratus Pfr., xii, 34.
piescheli Mart.
D. lilacinus Rve., xii, 35.
patricius Rve.
v. undulosus, unicolor, crossei, jansoni, ictericus Mart.
D. serperastrum Say., xii, 37.
serperastrus Say.
liebmanni Pfr.
ziebmanni Rve.
nitelinus Rve.
paivanus Pfr.
D. ziegleri Pfr., xii, 39.
californicus Rve., xii, 40.
D. lattrei Pfr., xii, 41.
delattrei F. & C.
focillatus Rve.
pazianus Tristr.
v. hiabundus Mart., xii, 42.
D. chiapasensis Pfr., xii, 42.
chiapensis Mart.
D. castus Pfr., xii, 43.
D. dunkeri Pfr., xii, 45 ; xiv, 162.
v. forreri Mss., xii, 46.
fenestratus Phil.
fenestralis Alb.
D. chaperi C. & F., xii, 46.
D. colimensis Rolle, xii, 47; xiv, 162.

Group of D. sulcosus.

D. botterii C. & F., xii, 47.
D. sulcosus Pfr., xii, 48.
hyematus Rve.
D. rudis Ant., xii, 49.
D. ghiesbreghti Pfr., xii, 50.
v. stolli Mart.
v. interstitialis Mart.
v. iodostylus Pfr.
D. hegewischi Pfr., xii, 52 ; xiv, 152.
? *nitidulus* Bk.
D. jonasi Pfr., xii, 54.
D. aurifluus Pfr., xii, 55; xiv, 162.
D. recluzianus Pfr., xii, 55.
D. lineolatus Conr., xii, 57.
D. lirinus Morel., xii, 57.
D. cucullus Morel., xii, 58.
v. gracilior F. & C.

Group of D. attenuatus.

D. fenestrellus Mart. xii, 58.
gealei H. Ad.
v. subunicolor Mart., xii, 59.
D. attenuatus Pfr., xii, 60.
kefersteini Pfr.
v. varicosus Pfr., xii, 61.
v. pittieri Mart., xii, 61.
D. trimarianus Mart., xii, 62.
D. hepatostomus Pfr., xii, 62.
D. costaricensis Pfr., xii, 63.
navarrensis Angas.
D. pluvialis Pfr., xii, 64.
D. bugabensis Mart., xii, 64.
D. chiriquiensis DaC., xiv, 162.

D. sargi C. & F., xii, 65.
v. motaguæ Mart., xii, 65.
D. droueti Pfr., xii, 65.
v. sporlederi Pfr., xii, 66.
D. inglorius Rve., xii, 67.
v. heynemanni Pfr., xii, 68.

Group of D. tripictus.

D. irazuensis Ang., xii, 68.
D. tripictus Alb., xii, 69.
rhodotrema Mart.
v. hoffmanni Mart., xii, 70.
D. gabbi Ang., xii, 70.
gabbianus W. G. B.
angasi Mart.

Group of D. totonacus.

D. semimaculatus Pils., xii, 71.
D. totonacus Streb., xii, 71.
D. dominicus Rve., xii, 72.
D. albostriatus Streb., xii, 72.
D. championi Mart., xii, 73.
D. emeus Say, xii, 73.
ziegleri Rve.
palpaloensis Streb.
v. hypozonus, albivaricosus and membranaceus Mart.
D. tryoni F. & C., xii, 75.
mexicanus Rve.
v. pochutlensis C. & F.

Group of D. sulphureus.

D. sulphureus Pfr., xii, 76; xiv, 162.
sulfureus Mart.
v. citronellus Ang., xii, 78.
v. obesus Mart., xii, 78.
D. moricandi Pfr., xii, 78.

Group of D. multilineatus.

D. multilineatus Say, xii, 79, 27.
D. moritinctus Mart., xii, 79.
D. livescens Pfr., xii, 80.
D. discrepans Sowb., xii, 81.
D. semipellucidus Tristr., xii, 82.
D. heterogeneus Pfr., xii, 85.
D. uhdeanus Mart., xii, 83.
v. cuernavacensis C. & F.
v. tepecensis Mart.
v. borealis Mart.
D. tropicalis Morel., xii, 85.
D. inusitatus Fult., xiv, 162.

Group of D. alternans.

D. alternans Bk., xii, 86.
vexillum Brod.
v. juquilensis Mart., xii, 88.
D. tricingulatus Ant., xii, 88.
D. panamensis Brod., xii, 90.
D. hondurasensis Pfr., xii, 88.
honduratianus Tristr.
honduranus Mart.
D. translucens Brod., xii, 89.
v. subfloccosus Pils., xii, 90.

Section *Stenostylus* Pilsbry, 1898. Peru to Colombia.

D. kochi Pfr., xi, 314.
D. guttula Pfr., xi, 314.
D. goudoti Pet., xi, 314.
D. troscheli Phil., xi, 314.
D. nigrolimbatus Pfr., xi, 315.
D. meleagris Pfr., xi, 315.
D. colmeiroi Hid., xi, 316.
D. tapadoides Ph., xi, 317.
D. ignobilis Ph., xi, 317.

Subgenus Leiostracus Alb., 1850.

Albers, Die Hel., 1850, p. 156. Pilsbry, Manual xii, p. 90.

Perforate, ovate pyramidal shells with the brilliant and usually banded or streaked surface of *Drymæus;* but the nepionic shell has extremely minute spiral striæ and occasionally some slight vertical wrinkles.

The jaw (of *D. perlucidus*) is like that of *Drymæus.* The radula (pl. 58, fig. 78) has brace-shaped (⌣⌣) transverse rows running forward from middle to margins, and with *comparatively few teeth in a row*, the formula of *D. perlucidus* being 19.9.1.9.19. The centrals have a single rather wide cusp shorter than the basal-plate. The laterals have a very broad, rounded main cusp and a well developed ectocone. The main cusp becomes emarginate on the marginals, and finally bifid, and the ectocone also splits (pl. 58, fig. 76, *D. perlucidus.*) The mantle is green in this species.

Leiostracus differs widely from *Drymæus* in its diverse, probably degenerate, apical sculpture, in *the reduced number of teeth*, and the entire, rounded cusps of the laterals. In all true *Drymæus* the lateral teeth are tricuspid. These differences will probably make it advisable to raise the group to generic rank; but until the radula of the type species, *D. vittatus*, is examined, I prefer to treat it as a subgenus of *Drymæus;* the natural position of *Leiostracus* being between *Drymæus* and *Zaplagius.* The species are all Brazilian.

D. vittatus Spix, xii, 91.
H. coxeirana Moric.
H. caxoeirana Moric.
B. candidus Gray.
B. omphalodes Mke.
D. obliquus Rve., xii, 93; xiv, 163.
jeffreysi Pfr.
D. clouei Pfr., xii, 94.
D. onager Bk., xii, 94.
zebra Spix.
v. subtuszonata Pils., xii, 95.
D. vimineus Moric., xii, 95.
D. manoeli Moric., xii, 96.
coxiranus P. & M.
D. cinnamomeolineatus Moric., xii, 97.
D. perlucidus Spix, xii, 98.
opalinus Sowb.
H. angulosa Fér.

Genus BOTHRIEMBRYON Pilsbry, 1894.

Manual XIII, p. 1. *Liparus* of authors, not of Albers or Olivier.

The shell in this group is similar to that of *Bulimulus*. The soft anatomy is known by the work of Deshayes and Semper on *B. melo*, and of Hedley on *B. mastersi*, *tasmanicus* and *spenceri*.

The triangular kidney is as short as the pericardium in *B. melo*. The genital system in all the species examined, shows a long, slender penis, corrugated inside and without papilla, tapering into an epiphallus above, which receives the vas deferens midway and the retractor muscle at the apex (*melo*), or has a very delicate retractor attached to the membrane enveloping the vagina (*spenceri*), or is apparently without retractor, and ends in a long, coiled flagellum (*tasmanicus*). The oval spermatheca is upon a duct about as long as the oviduct, and attached to its enveloping membrane (pl. 51, fig. 20, *B. melo*, after Semper).

The jaw is thin and delicate, composed of 11 (*melo*), 15 (*mastersi*), 16 (*spenceri*), 32 (*tasmanicus*) plaits, which denticulate the lower or both edges and converge obliquely, leaving a triangular plait in the middle (pl. 60, fig. 10, *B. tasmanicus*, after Hedley).

The radula has 29.10.1.10.29 teeth in *B. melo*, 40.5.1.5.40 in *B. mastersi*, 32.15.1.15.32 in *B. spenceri*, 84.5.1.5.84 in *B tasmanicus*. The teeth have squarish basal plates and pointed cusps of the ordinary Helicid form, the centrals with the mesocone shorter than or about as long as the basal plate below it, ectocones small (*melo*, *spenceri*), or wanting (*mastersi*, *tasmanicus*). The lateral teeth have longer mesocones and distinct ectocones. The marginals have the mesocone or both mesocone and ectocone split in some species, while in *spenceri* they remain simple, and "to the remotest marginals the mesocone dominates the ectocone."

Notwithstanding its isolation, this genus differs from South American *Bulimulinæ* in minor characters only, so far as we now know. The radula is of undifferentiated type, like that of *Bulimulus*, but the jaw has converging plaits as in *Drymæus Placostylus*, etc., and unlike *Bulimulus*. The genital system is identical with that of *Bulimulus* and *Drymæus* in *B. melo*, and also in the other species examined, except for the somewhat conflicting statements regarding the apex of the penis and its retractor muscle, which call for re-examination. The kidney is strictly Bulimuline, according to Semper; but the ancient and probably not very exact figure in the *Regne Animal*

shows a pallial system somewhat unlike known American Bulimuli, in the partial rotation of the pericardium and kidney. A tendency toward that condition exists however in some forms of *Drymæus*. I regret that want of material prevents a new examination of the pallial organs and retractor muscles.

Bothriembryon inhabits South Australia and Western Australia, with a single species in Tasmania.

B. dux Pfr., xiii, 3.
B. inflatus Lam., xiii, 3.
? *costulata* Fér.
melones Fér.
ovum Dh.
v. melo Q. G., xiii, 5.
v. castaneus Dh., xiii, 5.
v. maculiferus Pils., xiii, 5.
v. conispira Pils., xiii, 5.
B. martensi Kob., xiv, 166.
B. spenceri Tate, xiii, 6.
B. kingii Gray, xiii, 7.
trilineata Q. G.
sayi Pfr.
quoyi Cox.
v. solidus Pils., xiii, 9.
v. naturalistarum Kob., Conch. Cab., p. 781.
v. maxwelli 'Braz.,' Kob.
B. physodes Mke., xiii, 234.
physoides Reeve., xiii, 9.
B. brazieri Ang., xiii, 10.
v. humilis Pils., xiii, 10.
B. gratwicki Cox, xiii, 11.
B. onslowi Cox, xiii, 11.
v. minor Pils., xiii, 12.
hartogensis Kobelt, xiv, 166.
B. leeuwinensis Sm., xiii, 13.
B. indutus Mke., xiii, 13.
? *rhodostoma* Gray.
v. pallidus Tate, xiii, 15.
B. bulla Mke., xiii, 15.
B. baconi Bens., xiii, 16.
B. angasianus Pfr., xiii, 16.
B. mastersi Cox, xiii, 17.
B. gunni Sowb., xiii, 18.
tasmanicus Pfr.
v. brachysoma Pils., xiii, 19.

Genus PLACOSTYLUS Beck, 1837.

Manual XIII, p. 19. Type *P. fibratus* Martyn.

Chiefly large shells, the ground living species brown, often thick and ponderous, the arboreal species thinner and frequently variegated with green or white. Nepionic whorls thimble-punctate when unworn. Aperture and lip commonly orange-red.

The kidney (in *P. shongii*, pl. 51, fig. 15) is short and triangular, as long as the pericardium, with closed ureter and gut-ureter. The heart lies obliquely to the long axis of the lung. The capacious pulmonary vein bears no large branches. The first branch of the pericardial vein arises close to its origin, and is almost as conspicuous as the pulmonary vein, from which it is separated by the very long

first vein of the vena cava. The vena cava bears a second large vein which parts the two branches of the first branch of the pericardial vein. The general reticulation is faint, the veins mentioned having no large branches.

The free retractor muscles (of *P. shongii*, pl. 54, fig. 41, nat. size) are arranged as in the American *Bulimulidæ*. The right ocular retractor band arising from the face of the columellar muscle.

The genital system (pl. 51, fig. 23, *P. shongii*) is characterized by the very large size of the fleshy penis, at the distal end of which the short retractor muscle is inserted, its distal termination being on the lung floor. There is no internal papilla, but the walls are corrugated above (fig. 24), and bear a pilaster below (fig. 25). The vas deferens is imbedded in the superficial integument of the penis nearly to the base of the latter. The vagina is moderately long. The duct of the spermatheca is short, the uterus being fully double its length. A muscle binds the spermatheca to the oviduct. In *P. elobatus* (pl. 51, fig. 22, after Semper) Semper found a similar system, except that the penis and spermatheca duct are much shorter. *P. seemanni* and *P. fulguratus* have similar genitalia, all three being Fijian species. In *P. porphyrostomus* Fischer found the genitalia about as in *shongii*, except that the vagina and spermatheca with its duct are shorter. In *P. scarabus* the penis is shorter (J. de C., 1871, pl. 7).

The jaw is strongly arcuate, thick and brown, composed of many narrow plaits, converging toward the median line, the median plate wedge-shaped.

The radula is of the normal Helicid type. The central teeth have a strong mesocone, and small ectocones or none. The laterals are similar, but asymmetrical without an entocone. They gradually change to marginals by splitting of the mesocone. The radula of *P. shongii* I examined has about 20 lateral teeth on each side, followed by about 10 well-developed marginals, bordered by perhaps a dozen or more small irregularly developed and probably functionless marginal teeth. Semper found 120 to 158 teeth in a row in the Fijian species (Pl. 60, fig. 13, *P. fulguratus*, after Semper). There is a perceptible though not great difference in form between the marginal teeth of the Placostyles of Fiji and those of New Caledonia, Lord Howe Island and New Zealand.

Placostylus is typically Bulimuline in nepionic sculpture, teeth, jaw, kidney and free muscles. It varies from most American genera

in the shortening of the duct of the spermatheca, and the enlargement and evident functional importance of the first branch of the pericardial vein. The latter is well developed, however, in the American genus *Macrodontes*.

Section *Placostylus* s. str.

(Species of New Zealand.)

P. shongii Less., xiii, 22.
bovinus auct.
auris-bovina Petit.
hongii Suter, xiii, 235.
v. novoseelandicus Pfr., xiii, 24.
neozealanicus Hutton.
v. candidus Crosse, xiii, 25.

(Species of Lord Howe Island.)

P. bivaricosus Gask., xiii, 25.
v. cuniculinsulæ Cox, xiii, 26.
v. etheridgei Braz., xiii, 26.
v. solidus Eth., xiii, 27.

(Species of New Caledonia and the Loyalty Is.)

Group of P. bavayi.

P. eddystonensis Pfr., xiii, 30.
hienguenensis Crosse.
servaini Euthyme.
P. bavayi C. & M., xiii, 31.
v. dupuyi Kob., xiii, 31.
P. bondeensis C. & S., xiii, 32.
v. edentulus C. & S., xiii, 32.
P. curtus Cr., xiii, 33.
layardi Kob.
P. savesi Cr., xiii, 33.
P. rossiteri Braz., xiii, 34.

Group of P. fibratus.

P. alexander Cr., xiii, 35.
v. procerula, ouagapensis, crassus, leucostoma, nigricans Crosse, xiii, 36; patulus Kob., xiii, 236.
P. corpulentus Gass., xiii, 37.
P. abbreviatus Gass., xiii, 37.
P. kanalensis Cr., xiii, 38.
v. tchioensis Kob., xiii, 38.
thioensis Cr.
v. subeffusus Kob., xiii, 39.
P. fibratus Martyn, xiii, 39, 235.
B. alboroseus, *bulbulus*, *carbonarius*, *necouensis*, *infundibulum*, *superfasciatus*, *patens*, of Gassies; *B. f. pallidula* Crosse; *Voluta australis* Dillw.; *H. auris-bovinus* Fér.; *Auricula aurantiaca* Schum.; *B. bootis* Mke.
v. pinicola Gass., xiii, 42.

v. bovinus Brug., xiii, 42.
v. bairdii Rve., xiii, 42.
v. peculiaris Kob., xiii, 42.
v. leucolenus Cr., xiii, 42.
v. danieli Cr., xiii, 43.
v. knoblauchi Kob., xiii, 43.
v. insignis Pet., xiii, 43.
v. ouensis Gass., xiii, 43.
v. imbricatus Gass., xiii, 44.
v. lalannei Gass., xiii, 44.
v. grammicus Cr., xiii, 44.
v. crassus 'Lay.' Kob., xiii, 45.
aurismidæ Rve.
v. ventricosus Kob., xiii, 45.
v. ovalis Kob., xiii, 45.
v. ovata Cr., xiii, 45.
v. edwardsianus Gass., xiii, 45.
v. strigatus Pils., xiii, 46.
v. mareanus Cr., xiii, 46.
turrita Kob.
gareana Pfr.-Cless.

P. arenosus Gass., xiii, 46.
P. falcicula Gass., xiii, 46.
P. ouveanus 'Dotz.' Mss., xiii, 47.
sinistrorsus and *scalaris* Crosse.
æsopeus Gass.
v. lifouanus Cr., xiii, 48.
v. albus Cr., xiii, 48.
P. souvillei Morel., xiii, 48.
eximeus Alb.
P. lamberti Gass., xiii, 49.
P. boulariensis Sowb., xiii, 50.
P. guestieri Gass., xiii, 51.
v. gatopensis Cr., xiii, 51.
v. confusus Pils., xiii, 52.
cicatricosus Kob.
v. orientalis Kob., xiii, 52.
v. rhinocheti Kob., xiii, 52.
P. senilis Gass., xiii, 53.
v. minor Kob., xiii, 53.
v. subsenilis Gass., xiii, 53.
P. buccalis Gass., xiii, 53.
P. goroensis Souv., xiii, 54.

Group of P. porphyrostomus.

P. submariei Souv., xiii, 55.
v. *abbreviata* Souv.
P. mariei C. & F., xiii, 55.
v. simplex Cr.; v. curtus, Gass.
P. neckliaiensis Kob., xiii, 56.
P. porphyrostomus Pfr., xiii, 57.
lessoni Pet.
auris-bovina Rve.
v. singularis Morel., xiii, 58.
v. debeauxi Gass., xiii, 58.
v. umbilicatus Kob., xiii, 236.
P. monakensis Cr., xiii, 58.
dautzenbergi Marie.
P. duplex Gass., xiii, 59.
v. major Gass.
P. caledonicus Pet., xiii, 60.
v. edentulus Braz., xiii, 61.
P. poyensis Kob., xiii, 61.
v. goyettensis Cr., xiii, 62.
P. pseudocaledonicus Montr., xiii, 62.
Forms intermedius Cr., subulatus Cr. (*nigra* Gass.), dentatus Gass., palus Gass., rufus Gass., incertus Cr., hybridus Kob., pouenanus Kob.
v. chrysochilus Cr., xiii, 64.
gaudryanus Gass.
v. annibal Souv., xiii, 64.
v. saxtoni Kob., xiii, 65.
P. scarabus Alb., xiii, 65.
v. tanouensis Cr., xiii, 66.
v. smithii Kob., xiii, 66.
v. goulvainensis Kob., xiii, 67.

Species of the New Hebrides.

P. salomonis Pfr., xiii, 69.
P. fuligineus Pfr., xiii, 70.
P. heterostylus Pils., xiii, 72.
P. alienus Pils., xiii, 72.

Species of New Guinea.

P. remotus Hedley, xiii, 76.

Species of the Solomon Is.

Section *Placocharis* Pilsbry, 1900.

Man. Conch., xiii, p. 21, 79. Type *P. macgillivrayi.* Solomon Is.

Group of P. macgillivrayi.

P. founaki H. & J., xiii, 79.
hombroni Cr.
v. paletuvianus Gass.
rhizophorarus, etc., Gass.
P. kreftii Cox., xiii, 81.
P. guppyi Sm., xiii, 82.
P. macfarlandi Braz., xiii, 83.
brodiei Braz.
P. calus Smith, xiii, 83.
P. macgillivrayi Pfr., xiii, 84.
P. palmarum Mss., xiii, 85.
v. minor Kob., xiii, 86.
P. strangei Pfr., xiii, 87.
P. stutchburyi Pfr., xiii, 88.
v. mendanæ Kob., xiii, 89.
P. (?) coxi Pse., xiii, 90.

Group of P. scotti.

P. scotti Cox, xiii, 90.
P. uliginosus Heimb. Kob., xiii, 91.
v. hobsoni Cox, xiii, 237.
P. hargravesi Cox, xiii, 93.
v. heimburgi Kob., xiii, 93, 236.

Section *Aspastus* Albers, 1850.

Man. Conch., xiii, p. 94. Type *P. miltocheilus.* Solomon Is.

P. miltocheilus Rve., xiii, 94.
v. stramineus Braz., xiii, 95.
v. minor Braz., xiii, 95.
v. albolabris Braz., xiii, 95, 236.
P. sellersi Cox, xiii, 95.

Section *Eumecostylus* Albers, 1860.

Man. Conch., xiii, p. 96. Type *P. cleryi.* Solomon Is.

P. cleryi Recl., xiii, 96, 236.
P. sanchristovalensis Cox, xiii, 97.

Species of the Fiji Is.

Section *Euplacostylus* Crosse, 1875.

Man. Conch., xiii, p. 99. Type *P. seemanni.* Fiji Is.

P. seemanni Dohrn, xiii, 100.
P. koroensis Garr., xiii, 101.
P. kantavuensis Cr., xiii, 101.

Section *Callistocharis* Pilsbry, 1900.

Man. Conch., xiii, pp. 21, 102. Type *P. malleatus*. Fiji Is.

P. paeteli Kob., xiii, 102.
moussoni Graeffe.
P. garretti Pils., xiii, 103.
P. graeffei Cr., xiii, 104.
colubrinus Mouss.
moussonii Graeffe.
P. hoyti Garr., xiii, 105.
P. elobatus Gld., xiii, 105.
colubrinus Pfr.
v. albino Pils., xiii, 106.
P. guanensis Garr., xiii, 107.
gnauensis Schmeltz.
P. ochrostoma Garr., xiii, 108.
v. rambiensis Garr., xiii, 108.
P. pfeifferi Kob., xiii, 109.
elobatus var., Pfr.
P. vitiensis Garr., xiii, 110.
P. gracilis Brod., xiii, 110.
fulguratus Jay.
eximius Rve.
v. rugatus Garr., xiii, 112.
v. crassilabrum Garr., xiii, 112.
P. malleatus Jay, xiii, 112.
P. morosus Gld., xiii, 113.

Section *Leucocharis* Pilsbry, 1900.

Man. Conch., xiii, pp. 21, 67. Type *P. pancheri*. Soft anatomy unknown. Distribution, New Caledonia and Loyalty Is.

P. pancheri Cr., xiii, 67.
v. candida Cr., xiii, 68.
P. loyaltyensis Souv., xiii, 68.
P. porphyrochila D. & B., xiv, 167.
v. rubicunda Dautz. et Bern.

Section *Pœcilocharis* Kobelt.

Man. Conch., xiii, p. 73. Type *P. hartmani*. Distribution New Hebrides.

P. hartmani Kob., xiii, 73.
rossiteri Hartm.
hartmanni Kob.
P. bicolor Hartm., xiii, 74.
P. francoisi Mab., xiii, 74.
P. turneri Pfr., xiii, 75.
P. hebridarum Mab., xiii, 75.

Subgenus *Diplomorpha* Ancey, 1884.

Man. Conch., xiii, p. 114. Type *D. layardi*. New Hebrides.

P. layardi Braz., Hartm., xiii, 115.
P. brazieri Hartm., xiii, 116.
P. peasei Cox, xiii, 117.
P. delatouri Hartm., xiii, 117.
P. coxianus Pils., xiii, 118.
coxi Hartm.
P. ruga Hartm., xiii, 119.
P. bernieri Hartm., xiii, 119.

Sub-family ODONTOSTOMINÆ.

This vol., p. 24. As the anatomy of the genera of this group has been discussed in the present volume, and the species described, it would be superfluous to give a summary of them in this place.

The less specialized forms of *Odontostominæ* apparently had a wider geographic range in the past than any living genus of the sub-family. *Hyperaulax*, which is not greatly modified from *Bulimulus*, occurred in the Floridian Oligocene at the time when Florida was not connected with the North American continent, but had a purely Antillean snail-fauna.

The genera are as follows:

Genus MACRODONTES Swains., p. 29.

Genus ANCTUS v. Mart., p. 36.

Genus ODONTOSTOMUS Beck, pp. 38, 169.

Section *Moricandia* Pils. & Van., p. 40.

Section *Bahiensis* Jouss., p. 46.

Section *Cyclodontina* Beck, p. 58.

Section *Odontostomus s. str.*, p. 62.

Subgenus SCALARINELLA 'Doer.' Dohrn, p. 66.

Subgenus SPIXIA Pils. & Van., p. 67.

Subgenus PLAGIODONTES Doer., pp. 92, 171.

Genus HYPERAULAX Pils., p. 102.

Section *Bonnanius* Jouss., p. 103.

Genus TOMIGERUS Spix, p. 105.

Genus ANOSTOMA F. de Waldh., p. 109.

Section *Ringicella* Gray, p. 114.

Subfamily ORTHALICINÆ.

PILSBRY, Manual, xii, p. 99.

Shell imperforate with solid axis, varying from ovate to oblong-conic or pyramidal, the aperture ovate, toothless, columella simple and straight, or twisted or truncate below. Jaw composed of a small number (usually 14 to 20) of wide imbricating plaits. Teeth of the radula very numerous, part or all of them bearing broad gouge-shaped cusps. Cardiac side of the lung plain except near the pneumostome. Genitalia simple except for an appendix on the penis. Oviparous.

A natural group of tropical American snails, chiefly arboreal,

Bulimuline in their main features, but differing from the *Bulimulinæ* in the wholly imperforate shell, the appendix of the penis, developed in no other group of *Bulimulidæ*, the few broad and strongly imbricating plaits of the jaw, and a special modification of the teeth.

Synopsis of Genera.

I. Early whorls pitted.

a. Shell rather thin, capacious, with large, oblique aperture and simple, thin or somewhat thickened lip and columella, the former not expanded. Genus ORTHALICUS.

a^1. Shell solid, more lengthened, the aperture smaller, vertical or nearly so, the lips thick and blunt, or expanded or reflexed ; columella usually with one or two folds.

s. g. *Metorthalicus*.

II. Early whorls smooth, or with some radial wrinkles.

a. Shell ovate-conic, usually with coloration of festooned dark stripes, and three equidistant bands. Aperture rather large, ovate and oblique, the lip simple and unexpanded, columella straight or somewhat convex, not truncate below, Vagina and spermatheca duct long.

Genus OXYSTYLA.

a^1. Shell ovate-conic, solid, with ovate aperture, the lip reflexed, expanded, or merely blunt and rather thick. Vagina and spematheca duct short. Genus PORPHYROBAPHE.

a^2. Shell oblong-conic, with simple, thin-edged, unexpanded lip, the columella usually truncate below, either concave, folded or straight above. Genus LIGUUS.

b. Shell white or bright-colored, with rather small apex. Antillean. s. g. *Liguus*.

b^1. Shell dark colored, the columella concave above, abruptly truncate at the base. Colombia.

s. g. *Hemibulimus*.

b^2. Shell strong, the apex obtuse as though cut off, the columella bearing a callous fold above. Colors not vivid. South America. s. g. *Corona*.

The genital system of the *Orthalicinæ* (plate 55) is Bulimuline in its main features, and shows no important differences in the various genera. The atrium is very short. The penis bears an accessory

gland or appendix, usually composed of several lobes in *Oxystyla*, *Liguus*, *Porphyrobaphe* and *Metorthalicus*, but reduced to an annular swelling in *Orthalicus*. The penis is continued in an epiphallus to which the retractor and vas deferens are attached distally. The vagina is quite long, except in *Porphyrobaphe*. The small globose or ovate spermatheca lies near the heart, its duct being very long except in *Porphyrobaphe*, where the duct is much shorter than the uterus.

The kidney is small and triangular, as short as the pericardium, as in all *Bulimulidæ*. The lung is much lengthened, with a large, straight pulmonary vein with only very small branches. The pericardial vein is small, and gives forward but one large branch. Only the first, or right main branch of the anterior vena cava is well developed. The minor reticulation is confined to the intestinal side of the lung, and the anterior extreme of the opposite side, between the base of the first main branch of the vena cava and the end of the pulmonary vein; the rest of the cardiac side being free from visible reticulation (pl. 53, fig. 34, *Oxystyla undata jamaicensis*).

The free muscles resemble those of *Bulimulus* in general arrangement. The pharyngeal retractor unites at its proximal end with the left tentacular band, although both are free almost throughout. The pedal retractors are strongly developed, branching from both the right and left bands. The right tentacular retractor arises from the anterior face of the columellar muscle (pl. 54, fig. 36, *Oxystyla undata jamaicensis*).

The jaw (pl. 60, figs. 17, 18), is composed of a solid basal layer upon which the wide, imbricating plates of the anterior face are superposed. These plates seem to be free at their outer edges, which converge below towards the median line, but they are covered by a transparent outer layer, which is more or less costate vertically in some forms. The edges of the ribs alone are visible, by transmitted light, as in pl. 60, figs. 17, 18. The central plate may be either triangular or irregularly pentagonal, with the point downward.

The radula is very broad, with 170 to over 200 teeth in a transverse row, the rows widely V-shaped. The teeth have square basal plates, which in the median portion of the radula bear very broad, rounded or truncate cusps, longer than the basal plates and projecting beyond it on the sides. This cusp is to be regarded as compound, being composed of completely concrescent ento- meso- and ecto-cones

(pl. 56, fig. 58). Towards the sides a small ectocone gradually makes its appearance, becoming somewhat conspicuous on the outer marginal teeth, and the entocone is usually indicated by a slight notch in the cusp (pl. 56, fig. 57, 53).

This type of teeth resembles the *Zaplagius* type superficially, but differs fundamentally in that the ectocone is united with the mesocone, while in *Zaplagius* it is always distinct.

The broad, shovel-shaped type of cusp described above is sometimes replaced on the median and a few adjacent lateral teeth by long, lanceolate cusps. This modification has been observed in *Liguus virgineus*, *L.* (*Hemibulimus*) *magnificus*, *Orthalicus sultana* and *atramentarius*, *Oxystyla ferussaci* and *princeps*, though some individuals of the latter have the normal type of teeth. In my opinion, these lanceolate teeth have been modified from the rounded type, secondarily assuming a pointed shape; this view being based upon the general law of tooth-changes set forth in Vol. IX, p. xiii. The species of various genera possessing such teeth are unrelated, and have acquired them clearly by a parallel process. In *Oxystyla princeps*, as Strebel & Pfeffer have shown, the form of the cusps is not a constant specific character. The same is true of *Liguus*.

Genus OXYSTYLA Schlüter, 1838.

Vol. xii, p. 101. Synonyms are *Zebra* Shuttl., 1856, *Ortalichus* Martens, 1893, and *Orthalicus* of writers on North American species.

While the other genera are restricted in distribution, *Oxystyla* extends throughout the tropical and subtropical regions of both Americas, though in South America the species are more numerous and diversified.

The kidney and lung (pl. 53, fig. 34, *O. undata jamaicensis*), retractor muscles (pl. 54, fig. 36, *O. u. jamaicensis*) and jaw have been treated of under the subfamily head. The radula has about 100.1.100 teeth in *O. u. jamaicensis* (pl. 56, figs. 57, 58), the cusps being broad and rounded as usual. Most of the species investigated have similar teeth. In some forms of *O. princeps* and *O. ferussaci* (pl. 59, fig. 7, after Strebel) the middle and some adjacent lateral teeth have lanceolate cusps. When this is the case, the number of teeth so modified was found to be unequal on the two sides.

The jaw (pl. 60, fig. 18, *O. longa*) has been described above. The number of plaits varies in different species.

The genitalia (pl. 55, fig. 42, *O. princeps*, fig. 44, *O. u. jamaicensis;* fig. 46, *O. pulchellus*) are characterized by the very long duct of the spermatheca, both penis and vagina being of moderate length. The penis always bears a small accessory gland or appendix, which is usually parted in two lobes, which are subdivided in some forms.

Antillean Species, Trinidad to S. Florida.

O. undata Brug., xii, 105.
zebra auct.
A. undulata Gldg.
v. jamaicensis Pils., xii, 107.
v. reses Say, xii, 109.
v. floridensis Pils., xii, 110.

Species of Mexico and Central America.

O. princeps Brod., xii, 113.
v. trifracta Pils.
v. crossei Mart.
v. fischeri Mart.
v. elegans Rolle. xiv, 164.
Subsp. deceptor Pils., xii, 116.
obductus auct.
O. livens Shutt., xii, 118.
O. ferussaci Mart., xii, 119.
v. tricincta Mart., xii, 120.
O. melanocheilus Val., xii, 122.
O. zonifera Streb., xii, 123.
v. nobilis Rolle. xiv, 164.
O. livida Mart., xii, 124.
O. macluræ Mart., xii, 125.
O. longa Pfr., xii, 126.
v. strebeli Pils., xii, 128.
v. boucardi Pfr., xii, 128.
v. uhdeana Mart., xii, 129.
O. leucochilus F. & C., xii, 129.
O. ponderosa Streb., xii, 130.
O. decolor Streb., xii, 131.

South American Species.

O. obducta Shutt., xii, 134.
O. pulchella Spix, xii, 135.
v. prototypus Pils., xii, 137.
O. maracaibensis Pfr., xii, 137; xiv, 164.
f. imitator Pils., xii, 140.
v. subpulchella Pils., xii, 141.
O. fulvescens Pfr., xii, 141.
O. isabellina Mart., xii, 142.
O. bifulgurata Rve., xii, 143.
Z. fulgur Mill.
O. mars Pfr., xii, 143.
O. varia Mart., xii, 144.
B. phlogerus auct.
A. flogera P. & M.
O. phlogera Orb., xii, 145; xiv, 165.
O. macandrewi Sowb., xii, 147.
O. bensoni Rve., xii, 147.

Genus PORPHYROBAPHE Shuttl., 1845.

Manual xii, p. 149. Shell resembling *Oxystyla*, but more solid, with the peristome thick and blunt or reflexed. The nepionic shell is smooth, not pitted. Type *P. iostoma.*

Jaw (of *P. iostoma*, according to Fischer) composed of 19 plaits. Radula with 85.1.85 teeth, like those of *Oxystyla*. Genitalia (pl. 55, fig. 45, after Fischer) with the penis and vagina short, the gland or appendix of the penis large and lobed. The duct of the spermatheca is about half the length of the oviduct.

This genus differs from *Oxystyla* chiefly in the shortness of the spermatheca duct and vagina, and the thick or blunt lip of the shell. Distribution, northwestern Peru to Colombia.

Group of P. iostoma.

P. iostoma Sowb., xii, 150.
phasianella Val.
v. bilabratus Pils., xii, 152.
P. integer Pfr., xii, 153.
P. saturnus Pfr., xii, 153.
P. flori Jouss., xiv, 164.
saturanus and *satuanus* Pfr.

Group of P. irroratus.

P. irroratus Rve., xii, 155.
v. elongata Mill., xii, 156.
v. minor Mill., xii, 156.
P. subirroratus DaC. xiv, 163.
P. grevillei 'Sow.' Pfr., xii, 156.
P. iris Pfr., xii, 157.
wallisianus Mouss.

Group of P. dennisoni.

P. dennisoni Rve., xii, 158.
v. marmatensis Pils., xii, 159.
v. obscurata Mss., xii, 159.
? P. victor Pfr., xii, 160.

Genus LIGUUS Montfort, 1810.

Manual xii, p. 161. Long-conic, smooth shells, white, usually variegated in bands or streaks with pink, green or yellow, cuticle inconspicuous or absent; outer lip simple, not expanded; columella usually truncate below, sometimes continuous with the basal lip. The typical group inhabits the Greater Antilles, subgenera occurring in northern South America. The species so far as known are arboreal.

The mantle-edge (of *L. fasciatus*) bears two conspicuous flange-like lobes, one dorsal, the other along the left margin, and separated from the neck-lobe by a narrow notch. The kidney is short and triangular, with completely closed secondary ureter, as in *Oxystyla*. The reticulation of the lung is substantially as in *Oxystyla*, except that the first branch of the pericardial vein is longer, about as long as the pulmonary vein. The venation of the cardiac side of the lung is weak and sparse.

The genital system resembles that of *Oxystyla*, except that the appendix is decidedly larger, though of the same character. The penis retractor muscle is inserted on the floor of the lung. The duct of the spermatheca is as long as the oviduct. The right eye retractor passes between male and female branches of the genitalia.

The jaw (pl. 60, fig. 17, *L. fasciatus*, Miami, Fla.) is similar to that of *Oxystyla*, composed of 16 plates, the median one small and triangular.

The radula is very broad, as in other *Orthalicinæ*, with broadly V-shaped rows of teeth. The teeth are somewhat less numerous than in *Oxystyla*, *L. fasciatus* having from 76.1.76 in a specimen I counted, to 69.1.69 according to Binney. The same author found 40.1.40 teeth in *L. virgineus*. The teeth are closely crowded near the middle of the radula (fig. 23), much more separated near the margins (fig. 23). The cusps of the central and first lateral teeth of *L. fasciatus* are elongate and pointed on the younger (posterior) end of the radula of a specimen from Miami, Fla. (pl. 61, fig. 22); over the median, functional portion of the radula the cusps are more obtuse and rounded (pl. 61, fig. 23); and anteriorly still more so. The laterals become wider, with a much broader, obtuse cusp; the ectocone, at first indicated by a slight sinuation, gradually becoming separated from the mesocone on the outer portions of the radula (pl. 61, fig. 23, teeth 67–69). The entocone is likewise indicated by a more or less pronounced notch on the outer teeth. In a radula of the same species, from Cardenas, Cuba, the central and lateral teeth are more obtuse, and Binney so figures them. In *L. virgineus* the central and first two lateral teeth were found to have long and somewhat pointed cusps (pl. 56, fig. 56, after Binney, central with 5 adjacent laterals, and the 39th and 40th teeth).

L. virgineus is from Haiti, the others from Cuba; *fasciatus* occurring also in southern Florida and Cozumel Island, off Yucatan.

L. virgineus L., xii, 162.
A. virginiæ Blv.
A. vexillum Humph.
A. emarginata Swains.
Ch. vittata Humph.
Helix regina Bowd., xiv, 165.
L. poeyanus Pfr., xii, 166.
L. blainianus Poey, xii, 174.

L. fasciatus Müll., xii, 166.
B. vexillum Brug., *A. pallida* and *crenata* Swains., *A. anais* Less., *A. lineata* Val., *A. lutea* Ant., *A. murrea* Rve., *A. picta* Rve., *H. hepatica* Bolt., *A. solida* Say.

Subgenus CORONA Albers, 1850.

A South American group of rather large, solid, lengthened species, either dextral or sinistral, the columella more or less truncate or excised at base, twisted and bearing a callous fold above. Soft anatomy unknown. Type *L. regina*, Fér.

Corona is considered by Mr. E. A. Smith to be more nearly related to the group of *Metorthalicus atramentarius* than to *Liguus*. *Cf.* Proc. Malac. Soc., v, p. 170.

L. regina Fér., xii, 177.
A. melastoma Swains.
A. melanostoma Gray.
O. rex dextrorsus Bk.

L. perversus Swains., xii, 178.
O. rex sinistrorsus Bk.

L. incisus Hupé, xii, 179.

L. regalis Hupé, xii, 180.
regina auct.
v. loroisianus Hupé, xii, 183.

L. pfeifferi Hid., xii, 146.
v. gracilis E. A. Sm., 1902.

Subgenus HEMIBULIMUS Martens, 1885.

Fusiform, dark-colored, with obtuse apex, the first whorl finely wrinkled. Columellar margin concave, distinctly truncated at base. The jaw (pl. 56, fig. 50) is composed of 13 imbricating plates, the median one reaching the basal margin. Radula with 62.2.1.2.62 teeth. The centrals are much lengthened, with a long, lanceolate mesocone and vestigeal side cusps. Two laterals on each side are similar, but asymmetrical. The rest of the teeth are short and broad, with quadrate base, very wide, short cusps, and a minute ectocone. The outermost marginals become tricuspid (pl. 56, figs. 51, 52, 53).

L. magnificus Pfr., xii, 185. Andes of Colombia.
v. excisus Mart., xii, 185.

Genus ORTHALICUS Beck, 1837.

Man. Conch. xii, p. 186. Strebel & Pfeffer, Beitr. Mex. Land-u. Süsswasser-Conchyl., Theil v, p. 2 (anatomy of *O. sultana*). W. G. Binney, Ann. Lyc. N. H. of N. Y. xi, p. 38 (anatomy).

In *O. sultana* from Guiana, Strebel found the right neck-lobe of the mantle strongly developed; the left forms a continuous rim around the entire mantle. The genital system (pl. 55, fig. 43) has the general characters of other genera of the sub-family, except that the appendix of the penis is represented by a circular swelling. The latter was not noticed by Binney, who examined a specimen from Marañon, Peru.

The jaw is composed of 15 plaits, the median ones not reaching the lower margin. The radula (pl. 56, fig. 55, *O. sultana* from Marañon, after Binney) has over 108.1.108 teeth. The central and inner three laterals on each side have rather narrow basal-plates, and long, lanceolate cusps. The rest of the teeth are wide, with broad, short, rounded cusps, as usual in the subfamily.

O. sultana Dillw., xii, 188.
H. gallina sultana Chemn.
O. sultana Beck.
A. pavonina Spix.
O. meobambensis Pfr., xii, 191.
O. trullisatus Sh., xii, 191.

Subgenus METORTHALICUS Pils.

The anatomy of *O. atramentarius* has been examined by Strebel and Pfeffer. The lower portion of the penis is much swollen; it bears a large appendix, which is slightly lobed distally (pl. 55, fig. 48, 47, section of penis and appendix, f. 49, appendix). The median plaits of the jaw are markedly triangular. The radula (pl. 56, fig. 54) has the central tooth, three laterals on one side and four on the other, of the narrow, lanceolate shape which occurs in *O. princeps*, *O. sultana*, *Liguus virgineus* and *magnificus;* the other teeth being of the usual broadly rounded form.

Group of O. fraseri.

O. buckleyi Higg., xii, 193.
O. fraseri Pfr., xii, 193.
v. brevispira Pils., xii, 194.
O. galactostoma Anc., xii, 194.
O. augusti Jouss., xii, 195.

Group of O. deburghiæ.

O. deburghiæ Rve., xii, 196.
gloriosus Pfr.
v. elongata Mill., xii, 198.
O. wrzesniowskii Lub., xii, 198.
O. maranhonensis Alb., xii, 198.

Group of O. labeo.

O. labeo Brod., xii, 199.
O. vicarius Fult., xii, 200.
labeo Rve.
O. shuttleworthi Alb., xii, 201.
O. yatesi Pfr., xii, 202.
v. sublabeo 'Dohrn' Anc.
v. latevittata Shutt.
O. kelletti Rve, xii, 204.
v. fungairinoi Hid., xii, 204.
jatesi Hupé.

Group of O. atramentarius.

O. powisianus Pet., xii, 206.
O. adamsoni Gray, xii, 207.
f. maculatus Pils., xii, 208.
O. approximatus Fult., xii, 209.
O. atramentarius Pfr., xii, 209.
boussingaultii Hupé.
iodes Shuttl.

Subfamily AMPHIBULIMINÆ.

Manual xii, p. 211. This group includes *Bulimulidæ* in which the shell is more or less degenerate, *Succinea*-shaped, *Haliotis*-shaped, or in the less modified forms, globose or ovate; always thin and mainly cuticular.

The group is a provisional one in its present limits, and probably composed of two independent lines of specialization: one from the *Drymæus*, *Zaplagius*, *Oxychona* radical, leading to *Simpulopsis* and *Peltella;* the other perhaps diverging from a *Bulimulus*-like stem, including *Amphibulima* with its satellite groups, and *Gæotis.*

Genus SIMPULOPSIS Beck, 1837.

Manual xii, p. 212.

The jaw is unknown, but probably like that of *Drymæus.* The radula of *S. sulculosa* has V-shaped rows of 70 teeth each, obliquely running forward, as in *Zaplagius* and the *Orthalicinæ.* The rhachidian tooth has a single conic cusp. The laterals have the mesocone much expanded, broad, ectocone small but well developed. The marginal teeth (fig. 12) resemble those of *Drymæus* and *Peltella*, having an oblique, trifid, broad cusp, the ectocone split (pl. 62, fig. 34, *S. sulculosa*, after Heynemann). The soft anatomy is otherwise unknown.

The species of the typical section are from Brazil, south of the Amazon, except *corrugata* from Trinidad and *vincentina* from St. Vincent.

S. atrovirens Moric., xii, 213.
S. sulculosa Fér., xii, 214.
membranacea Mich.
S. brasiliensis Moric., xii, 215.
obtusa Pfr.
S. obtusa Sowb., xii, 216.
ovata Sowb.
S. rufovirens Moric., xii, 216.
rufescens H. & A. Ad.
S. corrugata Gupp., xii, 217.
S. miersi Pfr., xii, 218.
S. tryoni Pils., xii, 218.
S. decussata Pfr., xii, 218.
S. (?) vincentina Sm., xii, 219.

Mexican Species.

S. simula Morel., xii, 219. S. cumingi Pfr., xii, 220.

Section BULIMULOPSIS Pils., 1899.

Manual xii, p. 220. The soft anatomy of this group is unknown. Type *S. pseudosuccinea*. The species are Brazilian.

S. pseudosuccinea Moric., xii, 221. S. boissieri Moric., xii, 222.
moricandi Pfr. S. progastor Orb., xii, 223.
S. citrinovitrea Moric., xii, 221.
B. vitrinoides Rve.

Subgenus PLATYSUCCINEA Ancey, 1881.

Manual xii, p. 223. *S. ænea* is Mexican, the other species Antillean.

S. portoricensis Shutt., xii, 224. S. dominicensis Pfr., xii, 225.
S. psidii Mart., xii, 224. S. ænea Pfr., xii, 225.

Genus PELTELLA Webb and Van Beneden, 1836.

Manual, xii, p. 231. v. Ihering, Malak. Blätter (n. F.), viii, p. 57 (anatomy).

Slug-like, with the mantle large posterior, elevated, and perforate over a *Haliotis*-shaped fragile shell, consisting of between 1½ and 2 whorls. The jaw is highly-arched, closely plaited, very narrow in the middle (pl. 62, fig. 36). The radula is large, with 93.1.93 teeth in nearly straight transverse rows. The basal plates of the teeth are rhombic. Median tooth unicuspid, laterals with three cusps, as in *Drymæus* (pl. 61, fig. 26). The genital system (pl. 62, fig. 37) resembles that of *Bulimulus* except that *the duct of the spermatheca is very short.* The free retractor muscles are shortly united proximally. The columellar muscle is apparently degenerate. An excellent account of the anatomy has been given by Von Ihering, who first referred *Peltella* to the *Bulimulidæ*.

The genus is very distinct in many respects, and especially in the shortness of the duct of the spermatheca, the anal pouch, apparent absence of the columellar muscle, and of course the modifications consequent upon the reduction of the shell. The teeth of the radula seem to be almost identical in form with those of *Drymæus*.

P. palliolum Fér., xii, 231. Brazil, near Rio de Janeiro.

Genus AMPHIBULIMA Lamarck, 1805.

Manual, xii, p. 232. Type *A. patula* Brug. *Amphibulia* RAFINESQUE, Binney & Tryon edit., p. 17.

Shell Succinea-shaped; $1\frac{1}{2}$ apical whorls corrugated in the typical forms, smooth in s. g. *Pellicula*.

In *Amphibulima patula christopheri*, the kidney (pl. 62, fig. 27, K) is longer than the pericardium, its apex covered with venous reticulation. The ureter and secondary ureter (fig. 27, Ur.) are closed. The reticulation of the lung is anterior and on the gut or intestinal side, but extends further on the cardiac side than in *Bulimulinæ*. The pulmonary vein seems to receive a large branch near its cardiac end. The reticulation spreads over the base of the pulmonary vein and the adjacent apex of the kidney. The greater part of the cardiac side of the lung is plain or weakly veined, as usual in the family.

The retractor muscles are essentially Bulimuline. The pharyngeal retractor spreads but is not split distally, at its insertion on the large buccal mass. At its base it is shortly united to the proximal end of the left ocular and pedal band. The right ocular band arises from the anterior surface of the broad columellar muscle, and retracts the eye through the branches of the genitalia. The connections of the muscles thus agree in all respects with *Bulimulus*, *Placostylus*, etc. (pl. 62, fig. 29).

The genital system (pl. 62, fig. 28) shows a short and very wide vagina and penis, the vas deferens inserted near, the retractor muscle at, the distal end. The duct of the spermatheca is very long and slender, abruptly swollen at its base and bound to the oviduct throughout. The albumen gland is small, the ovisperm duct being knotted adjacent to it. The ovo-testis is a large, compact mass of long, dichotomose cæca.

The jaw is horse-shoe-shaped, thin and flexible, composed of many (50–56) narrow plaits, the median ones not reaching the lower margin in the specimen examined by me (pl. 62, fig. 30, *A. patula* var. *christopheri*).

The radula of a St. Kitts specimen (*A. patula christopheri*, pl. 60, figs. 11, 12) is comparatively large, composed of about 160 teeth in a transverse row, the formula being 62.17.1.17.62, the 15th to 20th teeth on each side being transitional from laterals to the marginal type. The central row bears teeth with well expanded basal plates,

broad, rounded mesocones, and well developed ectocones. The laterals are similar, but asymmetrical by suppression of the entocone, as usual (pl. 60, fig. 11). The ectocone gradually increases, until on the transition teeth (left side of fig. 11) it is not greatly smaller than the mesocone. The inner marginals (last tooth to the left in fig. 11) have two subequal cusps. The outer marginal teeth (fig. 12) have three or four slender denticles, on a long, curved basal-plate, which on the outermost teeth is indistinguishable from the basement membrane except near the cusps.

Binney found substantially the same type of teeth in St. Kitts examples. Those from Dominica have a longer, pointed cusp on the central tooth, while Fischer found the cusps long and conic in the Guadalupe form, which with the same number of teeth in a transverse row has 20 laterals. The central teeth have no ectocones, according to Fischer. These divergencies indicate racial differentiation on the several islands, thus:—

a. Cusps of central and adjacent teeth pointed. *A. patula* and var. *dominicensis.*

b. Cusps of central and adjacent teeth broadly rounded or truncate; St. Kitts. Var. *christopheri* Pils.; pl. 60, f. 11, 12; pl. 62, f. 27–30.

A. patula is from Guadalupe and Marie-Galante, with varieties in Dominica, St. Kitts and Saba; *A. tigrina* is said to be from St. Vincent; *A. pardalina* and *A. browni* from Dominica, and *A. rawsonis* from Montserrat.

A. patula Brug., xii, 234.
cucullata Lam.
v. dominicensis Pils., xii, 237.
v. christopheri Pils., above.
A. tigrina Les. xii, 237.
A. pardalina Gupp., xii, 237.
A. browni Pils., xii, 238.
A. rawsonis Bld., xii, 239.

Subgenus Rhodonyx Fischer, 1873.

Shell immaculate, rose-tinted, *Succinea*-shaped. Jaw (pl. 62, fig. 32) similar to that of *Amphibulima*, having 60–63 plaits. Radula (pl. 61, fig. 25, after Binney) with 47.13.1.13.47 teeth. The central tooth is tricuspid, middle cusp very large and broad, emarginate or truncate at the apex, side cusps pointed. The latter and inner marginal teeth are similar but without the entocone. The outer marginal teeth have long, narrow basal plates, like those of *Amphibulima*, and tridentate

cusp, the two outer denticles larger, as in *Gæotis*. Genital system similar to that of *Amphibulima*.

A. rubescens Dh. xii, 240. Martinique.

Subgenus PELLICULA Fischer, 1856.

Shell oval, *Succinea*-like, smooth, with extremely large aperture and small spire, composed of less than two whorls; columella with a thin, blade-like appendage. Animal externally almost slug-like, the mantle reflexed over the shell (pl. 62, fig. 33, *A. appendiculata*, after Fischer).

The jaw resembles that of *Amphibulima* but has fewer plaits, 40 in *appendiculata*, 23 in *depressa*. The radula of *appendiculata* has 32.12.1.12.32 teeth. These centrals are tricuspids, the mesocone long and pointed; laterals with broader, shorter, but still conic cusps (pl. 62, fig. 31, after Binney). The genital system (pl. 62, fig. 35, *A. appendiculata*, after Fischer) is almost exactly like that of *Amphibulima patula*. Both species are from Guadalupe.

A. appendiculata Pfr., xii, 241. A. depressa Rang, xii, 242.

Genus GÆOTIS Shuttleworth, 1854.

Manual xii, p. 227.

The jaw is extremely thin and delicate, with over 40 narrow plaits, as in *Drymæus* and *Urocoptis*, but with no triangular area in the middle (pl. 61, fig. 24, after Binney).

The radula is composed of V-shaped rows of teeth (pl. 61, fig. 24). "Centrals with base of attachment very long, narrow, obtuse above, incurved at the sides, obtusely rounded and expanded at base [posterior end], near which is a short, gouge-shaped expanded cusp, whose lower edge has three bluntly rounded cutting points. Laterals same as centrals in shape, but a little longer, and asymmetrical from the disproportionate expansion of the cutting-point. Marginals same as laterals, but more slender, with more developed and graceful cutting-points, of which the median is pointed, often bifid. There is much variety in shape and denticulation of the cusps. The middle denticle is always the smallest" (*Binney*).

The form of teeth shows a relationship to *Amphibulima*. All the species known are from Porto Rico.

G. nigrolineata Shuttl., xii, 229. G. malleata Pils., xii, 230.
G. flavolineata Shuttl., xii, 229. G. albopunctulata Shuttl., xii, 230.

ERRATA.

Draparnaudia gassiesi. New name for *Bulimus turgidulus* Gassies (xiv, 16, 17), not *B. turgidulus* Desh. 1864.

Draparnaudia sinistrorsa Dh. xiv, 15. *Bul. sinistrorus* Dh. is preoccupied by *B. sinistrorsus* Serres.

Helicostyla fasciata Pils. This name will replace that of *Bulimus effusus* Pfr., viii, p. 31, not *B. effusus* Bruguiere.

Strophocheilus martensianus. New name for *Bulimus grandis* Martens (x, 26), not *B. grandis* Deshayes.

Bulimulus nanus Rve., x, 141. The name is preoccupied by Lamarck.

Bulimulus terebralis Pfr. x, 142, not of Bruguiere, will become *Bulimulus ischnus* Pils.

Bothriembryon inflatus Lam. xiii, p. 3. Name preoccupied by *Bulimus inflatus* Olivier, Voy. Emp. Oth., I, 417. It has been called *B. ovum* by Gistel and others.

Drymæus conus Pils. New name for *B. coniformis* Pfr. xi, 276, not of Bruguiere.

Vol. XIV, p. 105, lines 3 and 4 from top, for "Bounanni" read Buonanni.

INDEX TO BULIMULIDÆ, ETC.

NOTE.—Names of additional species originally described as *Bulimus*, will be found in the indices to *Achatinidæ* and *Buliminus*.

Names of genera and other groups are printed in SMALL CAPITALS; of synonyms in *Italic*. Numbers in black refer to the pages of the present part.

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